Measuring The Quality Of Pennsylvania's Commercial HMOs

CALENDAR YEAR 2004

TECHNICAL REPORT

THE PENNSYLVANIA HEALTH CARE COST CONTAINMENT COUNCIL

March 2006

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Copies of the *Measuring the Quality of Pennsylvania's Commercial HMOs* report and this document, the *Technical Report*, can be obtained by contacting the Council, or can be accessed electronically via the Council's Web site.

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TECHNICAL REPORT

MEASURING THE QUALITY OF PENNSYLVANIA'S COMMERCIAL HMOS CALENDAR YEAR 2004

OVERVIEW

This technical supplement accompanies the calendar year 2004 version of the *Measuring the Quality of Pennsylvania's Commercial HMOs* report. Included in this *Technical Report* are detailed descriptions of the data and their sources, explanations for the adjustments to the data, and presentation of the methodology used for risk adjustment of the utilization and clinical outcomes data. Also included are detailed explanations for data collection and verification procedures, selection of clinical conditions and outcomes for study, and other comparative measures. Descriptions of financial indicators, ratings of HMOs by members, and plan profile information are further explained.

The *Measuring the Quality of Pennsylvania's Commercial HMOs* report provides information related to the quality of health care services received by members of commercial Health Maintenance Organizations (HMOs) and related Point of Service (POS) plans licensed by the Department of Health to do business in Pennsylvania. The report brings together information from several sources that are of interest to purchasers, consumers, payors, and providers. This collection of information and data allows all interested readers to make comparisons among HMOs based upon a comprehensive set of data.

Utilization and outcome measures are provided for seventeen specific clinical conditions/treatments included in the report. The research methodology that yielded utilization and outcome ratings was complex and differs for all clinical conditions. Methodology development was based upon state-of-the-art research practice. This development included a review of the current medical outcome literature, discussions with practicing medical professionals, and careful examination and approval by the Council's Technical Advisory Group. Each clinical condition was selected because:

- it is of high importance to purchasers and consumers,
- it is generally a high-volume, high-risk, or high cost condition/procedure, and
- its management by HMOs and their providers can reasonably be expected.

DATABASES

The databases used to analyze each of the seventeen clinical conditions were derived from discharge data submitted to PHC4 by Pennsylvania health care facilities.

The Statewide database was comprised of cases where the patient:

- was under 65 years of age (except for diabetes in which the age interval was 18 years through 75 years),
- met the clinical inclusion criteria for one of the conditions investigated (see Appendix A: "Description of Study Population"), and
- was discharged from a Pennsylvania *general acute care* (GAC) or *specialty GAC* hospital (or received care in an inpatient or ambulatory surgical setting for breast cancer or neck and back procedures) between January 1, 2004 and December 31, 2004.

The HMO database was derived from the statewide database and included:

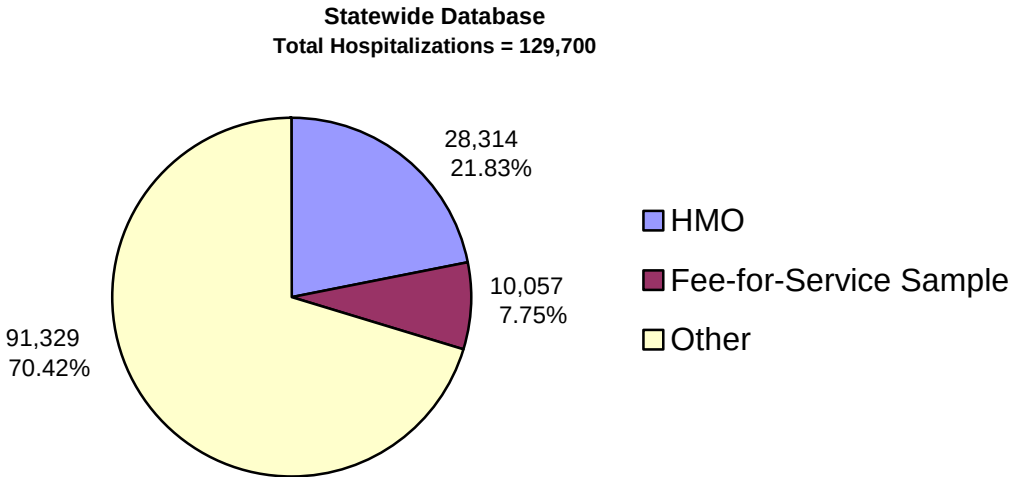
- aggregate hospitalizations for members of all commercial HMOs included in this report.

The "Fee-for-Service" Sample (Convenience) database was derived from the statewide database and included:

- aggregate hospitalizations for members of commercial, traditional "fee-for-service" plans (this group included only those patients who were clearly identified in a hospital record as a member of one of the larger fee-for-service plans in Pennsylvania). Hospitalization rates per member are not reported for this group because detailed enrollment data by plan were not available.

The "Other" group in the statewide database included:

- Hospitalizations where the payor was Medicare, Medicaid, or self-pay, as well as those records where the payor could not be identified.



Databases Used in the Risk Adjustment Process

Depending upon the condition under study, individual HMO plan data was compared to the statewide database, the HMO and fee-for-service sample databases combined, or the HMO database alone. Table 1 lists the comparative databases that were used to determine expected percents for each appropriate PHC4 measure (where actual percents were compared to expected percents), and to risk adjust each PHC4 measure that involved risk adjustment. For example, the statewide database for neck and back procedures included those cases where the patients met the definition criteria for neck and back procedures and were under age 65 but over age 17. This statewide database was then used as the comparative standard when determining the risk-adjusted length of stay for each HMO plan for neck and back procedures.

Results are presented in the public report in a manner that allows the reader to visually compare the results for individual HMO plans and the HMO state total/average. When the comparative reference was the statewide database or the HMO and fee-for-service sample combined database, summary data are also shown for the fee-for-service sample.

Table 1. *Comparative References*

Reported Measure	Database Used
Hospitalization/Procedure Rate	
▪ Pediatric Ear, Nose and Throat Infections	HMO Hospitalizations (members 28 days – 17 years)
▪ Adult Ear, Nose and Throat Infections ▪ High Blood Pressure	HMO Hospitalizations (members 18 – 64 years)
▪ Gastrointestinal Infections ▪ Kidney/Urinary Tract Infections	HMO Hospitalizations (members 28 days – 64 years)
▪ Chronic Obstructive Pulmonary Disease	HMO Hospitalizations (members 18 – 64 years)
▪ Pediatric Asthma	HMO Hospitalizations (members 28 days – 17 years)
▪ Adult Asthma	HMO Hospitalizations (members 18 – 64 years)
▪ Diabetes	HMO Hospitalizations (members 18 – 75 years with diabetes)
▪ Heart Attack ▪ Hysterectomy ▪ Breast Cancer Procedures ▪ Neck and Back Procedures ▪ Prostatectomy	HMO Hospitalizations (members 18 – 64 years)
Length of Stay	
▪ Chronic Obstructive Pulmonary Disease	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 64 years)
▪ Pediatric Asthma	HMO and Fee-for-Service Sample Hospitalizations (members 28 days – 17 years)
▪ Adult Asthma	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 64 years)
▪ Diabetes	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 75 years with diabetes)
▪ Heart Attack* ▪ Hysterectomy ▪ Breast Cancer Procedures ▪ Neck and Back Procedures ▪ Prostatectomy	Statewide Hospitalizations (age 18 – 64 years)
Rehospitalization Rating –180 days	
▪ Chronic Obstructive Pulmonary Disease ▪ Asthma (adult only)	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 64 years)
▪ Diabetes	HMO and Fee-for-Service Sample Hospitalizations (members 18 – 75 years with diabetes)
In-Hospital Mortality–30 days	
▪ Heart Attack	Statewide Hospitalizations (age 18 – 64 years)
In-Hospital Complications	
▪ Hysterectomy ▪ Breast Cancer Procedures ▪ Neck and Back procedures ▪ Prostatectomy	Statewide Hospitalizations (age 18 – 64 years)

*The Number of Days Hospitalized, rather than the Length of Stay, is reported for Heart Attack.

DATA SOURCES, COLLECTION, AND VERIFICATION

The data utilized in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report were obtained from several sources including: 1) discharge data submitted to PHC4 by Pennsylvania health care facilities, 2) the National Committee for Quality Assurance (NCQA) through the purchase of *Quality Compass®*, 3) the Pennsylvania Department of Health, and 4) the Pennsylvania Insurance Department. Pennsylvania hospitals verified data used to generate utilization measures and clinical outcomes, and HMO plans verified payor information listed in the hospital-submitted records. A more detailed explanation of the data and data sources follows.

PHC4: Hospital-Submitted Data and HMO Verification of Payor

Data specific to the seventeen clinical conditions were submitted to PHC4 by licensed Pennsylvania health care facilities. Refer to Appendix A: "Description of Study Population" for a listing of the diagnosis and procedure codes that defined each clinical condition in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report.

The process used by PHC4 to identify specific HMO payors for hospitalizations relied upon several different data fields in the discharge record:

- the payor type code, which indicates the type of payor and type of product,
- the National Association of Insurance Commissioners (NAIC) code, which identifies the company that paid for the claim, and
- the payor name field, which is a free-form text field filled by the hospital staff.

All records that clearly identified an HMO plan as the principal payor by these fields were directly assigned to that respective HMO for verification. In addition, a record was sent to an HMO plan if any part of a discharge record pointed to that particular HMO plan as the payor. This was necessary to assure inclusion of all appropriate records.

Records that were identified through this process as belonging to an HMO were then sent to the respective HMO plan for verification. The HMO plan could then either agree that the claim was paid for by the plan (accept the record), or disagree (reject the record).

Rejection of records by HMOs occurred for one of three primary reasons: 1) the patient was not a member of the HMO at the time of the hospitalization, 2) the HMO was not the primary payor, or 3) the patient was a member of the HMO, but under a line of business not eligible for this study (e.g., a Medicare HMO enrollee). A fourth reason for rejecting a record was specific to diabetes records in which the patient did not meet the diabetes population-specific criteria.

Also, plans could provide additional records that were not originally identified as belonging to them during the payor identification process. These added records were included in the analysis only if PHC4 was able to match them to valid records in the study population that had not yet been attributed to other plans.

Every HMO and related POS plan that received a file for verification from PHC4 reviewed, verified, and returned the data.

National Committee for Quality Assurance (NCQA)

NCQA is a private, not-for-profit organization dedicated to assessing and reporting on the quality of managed care plans. NCQA collects data via the Health Plan Employer Data and Information Set® (HEDIS) and the Consumer Assessment of Health Plans Study® (CAHPS) survey. These instruments assess health plan performance and member satisfaction with their HMO. These data, available collectively in NCQA's *Quality Compass®* (the central repository of data collected nationally from the NCQA accreditation surveys), are then available for purchase. Select outcome

measures from NCQA's *2005 Quality Compass* (2004 measurement year) are included in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report and are described below.

HEDIS Measures

HEDIS is a health plan performance tool developed by NCQA and is a component of the NCQA accreditation process. The "HMO State Average" for each measure (derived from the *Quality Compass* database and weighted by HMO enrollment) was calculated by PHC4. The *HEDIS Technical Specifications Manual* provides a detailed description of the calculations used to determine the numerator and denominator for these measures. The HEDIS "Effectiveness of Care" and "Use of Services" measures reported include:

Comprehensive Diabetes Care is a composite measure used to examine the frequency and results of certain tests for HMO members with diabetes. The measure evaluates HMO performance on six aspects of diabetes care using a single sample of members age 18 through 75 years of age who have Type 1 or Type 2 diabetes. The six components of the comprehensive diabetes care measure are expressed as a percent of members with diabetes who had each of the following:

- *Poorly Controlled Hemoglobin A1c Levels for Members with Diabetes*: Poor Hemoglobin A1c (HbA1c) control; that is, the most recent HbA1c test level within the calendar year 2004 that was greater than 9.0 percent. If no test was performed, then it was counted as poor HbA1c control.
- *Hemoglobin A1c Blood Tests for Members with Diabetes*: HbA1c tested; that is, at least one HbA1c test conducted during the calendar year 2004.
- *Eye Exams Performed for Members with Diabetes*: Eye exam performed; that is, an eye screening for diabetic retinal disease conducted during the calendar year 2004 or, in certain circumstances, the calendar year 2003.
- *Monitoring Kidney Disease for Members with Diabetes*: Kidney disease monitored; that is, a microalbuminuria screening performed during the calendar year 2004, or previous evidence of kidney disease such as a positive microalbuminuria screening or medical treatment for kidney disease.
- *Cholesterol Screening for Members with Diabetes*: LDL-C screening performed; that is, a low-density lipoprotein cholesterol test conducted during the calendar year 2003 or 2004.
- *"Bad" Cholesterol Controlled for Members with Diabetes*: LDL-C controlled; that is, the most recent low-density lipoprotein cholesterol test performed during the calendar year 2003 or 2004 that was less than 130 mg/dL. If there was no valid LDL-C value within the last two measurement years, it was counted as exceeding the threshold.

As a set, these six aspects of care provide a comprehensive picture of the clinical management of patients with diabetes.

Advising Smokers to Quit is reported as the percent of members 18 years and older who were continuously enrolled during calendar year 2004, who were either current smokers or recent quitters, who were seen by a plan practitioner during the measurement year, and who received advice to quit smoking.

Childhood Immunizations is reported as the percent of enrolled children who turned two years old during the calendar year 2004, who were continuously enrolled for 12 months immediately preceding their second birthday, and who were identified as having four DTaP/DT, one MMR, three H influenza type b, three hepatitis B, and one chicken pox vaccine(VZV). It is reported as a combination rate.

Timely Initiation of Prenatal Care is reported as the percent of women who delivered a live birth between November 6th of calendar year 2003 and November 5th of calendar year 2004, who were continuously enrolled at least 43 days prior to delivery, and who received a prenatal care visit in the first trimester or within 42 days of enrolling in the HMO.

Screening for Breast Cancer is reported as the percent of women age 52 through 69 years, who were continuously enrolled during the calendar years 2003 and 2004, and who had a mammogram during either of those two years.

Screening for Cervical Cancer is reported as the percent of commercially enrolled women age 21 through 64 years, who were continuously enrolled during the calendar years 2002 through 2004, and who received one or more Pap tests during one of those three years.

Cholesterol Management after Acute Cardiovascular Events consists of two measures referred to as Cholesterol Screening after Acute Cardiovascular Events and "Bad" Cholesterol Controlled after Acute Cardiovascular Events in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report. The first measure reports the percent of members age 18 through 75 as of December 31, 2004 who were discharged alive during the prior year for AMI, CABG, or PTCA, and had evidence of receiving an LDL-C screening on or between 60-365 days after discharge during the measurement year. The second measure reports the percent of those members that received this screening who had an LDL-C level of less than 130mg/dL.

Appropriate Medications for Members with Asthma evaluates whether members (age 5 through 56) with persistent asthma are being prescribed medications acceptable as primary therapy for long-term control of asthma. Members with "persistent" asthma were approximated based on services received during the prior year and medication utilization, rather than by a clinical measure of severity. The consistent use of the following medications resulted in a member being added to the numerator: Inhaled Corticosteroids, Cromolyn Sodium and Nedocromil, Leukotrine Modifiers, and Methylxanthines. Use of long-acting, inhaled beta-2 agonists was not included in the numerator.

Controlling High Blood Pressure is an intermediate outcome measure that assesses whether blood pressure was controlled among adult members with diagnosed hypertension. This measure can only be calculated by using the hybrid method (for further explanation of the hybrid methodology, see the *HEDIS Technical Specifications Volume 2*). For the Controlling High Blood Pressure measure, the hybrid method used membership data and ambulatory claims/encounter data to identify members ages 46 through 85 years of age with a diagnosis of hypertension and a medical record review to confirm the hypertension diagnosis and to assess blood pressure control during the membership year.

Beta Blockers after a Heart Attack is reported as the percent of commercial HMO members age 35 years and older as of December 31, 2004 who were hospitalized and discharged alive from January 1, 2004 through December 24, 2004 with a diagnosis of acute myocardial infarction (AMI) and who received an ambulatory prescription for beta blockers upon discharge. NCQA provides a list of contraindications to allow plans to adjust the number of commercial members who qualify for treatment.

Antidepressant Medication Management evaluates the successfulness of the pharmacological management of depression using the following three measures:

- *Members with At Least 3 Follow-Up Visits:* Percentage of members 18 years and older as of the 120th day of the measurement year who were diagnosed with a new episode of depression and treated with antidepressant medication, and who had at least three follow-up visits with a provider within 12-weeks of diagnosis (the Acute Treatment Phase).
- *Effective Acute Phase Treatment:* Percentage of members 18 years and older as of the 120th day of the measurement year who were diagnosed with a new episode of depression, were treated with antidepressant medication and remained on their prescribed drug during the entire 12-week Acute Treatment Phase.
- *Effective Continuation Phase Treatment:* Percentage of members 18 years and older as of the 120th day of the measurement year who were diagnosed with a new episode of depression who remained on their antidepressant prescription for at least 180 days.

Follow-up after Hospitalization for a Mental Illness reports the percent of members who received appropriate follow-up care within:

- *7-Days:* Percent of members six years and older hospitalized for treatment of selected mental health disorders who were seen on an ambulatory basis or were in intermediate treatment with a mental health provider within seven days of hospital discharge.
- *30-Days:* Percent of members six years and older hospitalized for treatment of selected mental health disorders who were seen on an ambulatory basis or were in intermediate treatment with a mental health provider within 30 days of hospital discharge.

Members Receiving Any Mental Health Services is reported as the percent of all members (no age restriction) receiving any mental health services during CY2004.

Inpatient Admission Rate is reported as the number of members (no age restriction) hospitalized for a mental health service per 1,000 plan members.

Inpatient Hospitalization Average Length of Stay is reported as the average number of days spent in the hospital for members (no age restriction) treated for a mental health service.

Colorectal Cancer Screening is reported as the percent of adults age 51 through 80 years, who were continuously enrolled during the calendar years 2003 and 2004, and who had appropriate screening for colorectal cancer. Appropriate screenings are defined by any one of the following four criteria; fecal occult blood test (FOBT) during the measurement year, flexible sigmoidoscopy during the measurement year or the four years prior to the measurement year, double contrast barium enema (DCBE) during the measurement year or the four years prior to the measurement year, or colonoscopy during the measurement year or the nine years prior to the measurement year.

The source of the HEDIS data contained in the Measuring the Quality of Pennsylvania's Commercial HMOs report was Quality Compass® and was used with the permission of the NCQA. Any analysis, interpretation, or conclusion based on these data was solely that of PHC4; NCQA specifically disclaims responsibility for any such analysis, interpretation, or conclusion. Quality Compass is a registered trademark of NCQA.

HEDIS Rotation Strategy

Beginning with HEDIS 1999, NCQA implemented a measures rotation strategy. The purpose of the strategy is to reduce data collection burdens for the HMOs while still providing relevant and accurate data to consumers. The strategy allows HMOs to skip, for one year, the task of collecting data for certain HEDIS measures, and permits the plans to use the results from the previous year instead. Measures included in the rotation schedule must have been in the measurement set for two years and have stable data collection specifications. The following table provides a summary of all the plans that, per the NCQA guidelines, chose not to collect new data for 3 of the 24 HEDIS measures that were included in this year's managed care report:

	Aetna Health Inc	**CIGNA Healthcare of PA.**	**First Priority**	**Health America & Health Assurance**	**KHP Central**	**KHP West**
Beta Blockers After a Heart Attack	✓	✓	✓		✓	✓
Childhood Immunizations		✓	✓	✓		✓
"Bad" Cholesterol Controlled after Acute Cardiovascular Events		✓	✓	✓	✓	✓

CAHPS Measures

Another important component of the NCQA accreditation process is the CAHPS survey instrument. Commercial HMOs hire vendors from an NCQA-approved list to administer this member satisfaction survey. The *Measuring the Quality of Pennsylvania's Commercial HMOs* report includes calendar year 2004 CAHPS scores for 9 Pennsylvania plans.

Pennsylvania Department of Health

Each HMO licensed by the Pennsylvania Department of Health files an *Annual Report* each April that summarizes enrollment, provider network and financial data from the previous calendar year (as of December 31st). Information from these *Annual Reports* is on the Council's Web site in the "Plan Profile" section.

National Association of Insurance Commissioners (NAIC)

Each plan is required to file a detailed annual financial statement with the NAIC. PHC4 produced the financial indicators from the data contained in those annual statements. Each plan had an opportunity to review the financial indicators developed by PHC4.

DESCRIPTION OF HOSPITALIZATIONS USED IN ANALYSES

Discharge data submitted to PHC4 by Pennsylvania health care facilities is housed in the Database of Record (DBOR). Once the submitted data is verified by the hospitals, the DBOR is analyzed to identify unique patients and their hospitalization histories. This process involves linking the individual hospitalizations of each unique patient, identifying each hospitalization as an index or non-index hospitalization, and creating episodes of care. Accurate construction of hospitalization histories and correct identification of the various components within a hospitalization history is crucial to PHC4 research methodology. The following paragraphs define the components of a hospitalization history and explain their role in the analyses for the seventeen clinical conditions included in the report.

Procedures For Linking Hospitalizations

The patient Social Security Number (SSN), sex, and date of birth, as reported by the hospitals, are used to identify patients across hospitalizations. In the vast majority of instances these values are identical for the same patient. Inconsistencies in essential data elements were resolvable if the discrepancy was clearly a typographical error (e.g., October 13 and October 31 of the same year). In this instance both records are assigned to the same patient. Hospitalizations assigned to the same patient are linked to create the hospitalization history.

Index Hospitalizations

After the linking of hospitalizations for unique patients is complete, the index hospitalization for each particular condition represented in that patient's hospitalization history is identified. For any single patient, the index hospitalization is the first hospitalization in the study period that meets the study population inclusion criteria. Therefore, there is only one index hospitalization per patient per condition.

Episode Of Care

An episode of care is comprised of the acute care hospitalization(s) associated with a patient's need for inpatient care. Single-hospitalization episodes of care are especially frequent for the

preventable hospitalizations such as those in the "Preventing Hospitalization through Primary Care" section of the *CY2004 Measuring the Quality of Pennsylvania's Commercial HMOs* report. Multiple-hospitalization episodes are more frequent for chronic illnesses (i.e., COPD, Asthma, Diabetes) and Heart Attack. Episodes involving more than one hospitalization are an important aspect of PHC4 methodology in that they account for the intricately related hospitalizations that are typical of the comprehensive care required to treat an illness.

For conditions other than Heart Attack:

- Multiple-hospitalization episodes consist of a string of contiguous acute care inpatient hospitalizations. For two contiguous hospitalizations to be considered part of the same episode, the discharge date of the first hospitalization must be the same date as the admission date of the second hospitalization.
- Multiple-hospitalization episodes may be comprised of hospitalizations with identical or differing principal diagnosis or procedure codes. For example, within the same diabetes episode a hospitalization with a principal diagnosis of diabetes may be followed by a hospitalization with a principal diagnosis of COPD.

For Heart Attack:

- Multiple-hospitalization episodes consist of the index AMI hospitalization and the acute care MDC 5 (Major Diagnostic Category 5: Diseases and Disorders of the Circulatory System*****) hospitalizations that began within 30 days of the admit date of the index heart attack hospitalization.
- These hospitalizations may or may not be contiguous. It is <u>not</u> necessary for the discharge date of the first hospitalization to be the same date as the admission date of the second hospitalization.
- Multiple-hospitalization episodes may be comprised of hospitalizations with identical or differing principal diagnoses as long as the hospitalization is classified as MDC 5.

Hospitalizations and Measures

All utilization and outcome measures for the seventeen clinical conditions in the *CY2004 Measuring the Quality of Pennsylvania's Commercial HMOs* report relied on the linking of hospitalizations and the proper identification of index and non-index hospitalizations. Table 3 lists all the measures reported for each clinical condition and details the hospitalizations that were used to extract utilization and/or clinical information for each measure. All episodes in a patient's hospitalization history and all hospitalizations in a multiple-hospitalization episode were not necessarily used for each measure. For example:

- The hospitalization rates for COPD were based upon the number of individual members that were hospitalized for this condition. If a person was hospitalized several times during the study period, only the index hospitalization was counted. Non-index cases were excluded so that a single member was counted in the hospitalization rate analysis rather than individual hospitalizations. Therefore, the number of members hospitalized for COPD was the basis of the hospitalization rate, not the number of hospitalizations for COPD.
- The percent rehospitalized for diabetes was also derived from the index hospitalization of each patient. However, to accurately assess percent rehospitalized across all HMO members hospitalized, the discharge date of the last acute care hospitalization in the diabetes episode was used to determine if the member had been rehospitalized within six months.

Additional hospitalizations were excluded from the analysis if they met certain clinical and procedural exclusion criteria. Refer to subsequent sections of this report that pertain to each

*Major Diagnostic Categories, used by the DRG system, are a broad classification of diagnoses typically grouped by body system.

clinical condition for detailed descriptions of the particular records excluded for each relevant measure.

Table 3. *Hospitalizations Used for Each Measure and Clinical Condition*

Condition	Data Source	Measure	Hospitalizations[1]
Ear, Nose and Throat Infections	PHC4	*Pediatric and Adult reported separately:* • Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate	• Index hospitalization only (one per member)[2]
High Blood Pressure	PHC4	• Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate	• Index hospitalization only (one per member)[2]
	HEDIS	• Controlling High Blood Pressure	Not Applicable
Gastrointestinal Infections	PHC4	• Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate	• Index hospitalization only (one per member)[2]
Kidney/Urinary Tract Infections	PHC4	• Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate	• Index hospitalization only (one per member)[2]
Chronic Obstructive Pulmonary Disease	PHC4	• Number of Hospital Admissions • Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate • Length of Stay (risk-adjusted)	• Index hospitalization only (one per member)[2]
		• Statistical Rating for Rehospitalizations – 180 day	• Index hospitalization (one per member)[2] • Any respiratory-related hospitalization beginning no more than 180 days after the discharge date of the last acute care hospitalization[3] linked to the index hospitalization
Asthma	PHC4	*Pediatric and Adult reported separately:* • Number of Hospital Admissions • Hospitalization Rate per 10,000 Members (age & sex-adjusted) • Statistical Rating for Hospitalization Rate • Length of Stay (risk-adjusted)	• Index hospitalization only (one per member)[2]
		Adult only: • Statistical Rating for Rehospitalizations – 180 day	• Index hospitalization (one per member)[2] • Any respiratory-related hospitalization beginning no more than 180 days after the discharge date of the last acute care hospitalization[3] linked to the index hospitalization
	HEDIS	Appropriate Medications for Members (age 5 – 56; percent)	Not Applicable

[1]Identifies the hospitalizations that were used to extract utilization and/or clinical information for the associated measure.
[2]Records with missing/invalid SSNs cannot be linked to a single member, and therefore were counted as separate members for the hospitalization rate. If records had matching valid social security numbers but had inconsistent birth dates or sex identifiers that could not be resolved, each record was counted as a single index hospitalization.
[3]Non-index hospitalization that may or may not have a principal diagnosis related to condition analyzed.

Table 3. *Hospitalizations Used for Each Measure and Clinical Condition* continued

Condition	Data Source	Measure	Hospitalizations[1]
Diabetes	PHC4	• Number of Members with Diabetes	Not Applicable
		• Number of Hospital Admissions • Hospitalization Rate per 10,000 Members with Diabetes (age & sex-adjusted) • Statistical Rating for Hospitalization Rate • Length of Stay (risk-adjusted) • Percent of Admissions for Short-term Complications of Diabetes	• Index hospitalization only (one per member)[2]
		• Statistical Rating for Rehospitalizations – 180 day	• Index hospitalization (one per member)[2] • Any diabetes-related hospitalization beginning no more than 180 days after the discharge date of the last acute care hospitalization[3] linked to the index hospitalization
	HEDIS	• Poorly Controlled Hemoglobin A1c Levels (percent) • Hemoglobin A1c Blood Tests (percent) • Eye Exam Performed (percent) • Monitoring Kidney Disease (percent) • Cholesterol Screening (percent) • "Bad" Cholesterol Controlled (percent)	Not Applicable
Heart Attack (AMI)	PHC4	• Number of Hospital Admissions • Hospitalization Rate per 10,000 Members (age & sex-adjusted)	• Index hospitalization only (one per member)[2]
		• Number of Days Hospitalized (risk-adjusted)	• All hospitalizations[4] beginning no more than 30 days from the admission date of the AMI index hospitalization
		• Expected In-Hospital Mortality—30 Day (risk-adjusted; percent) • Actual In-Hospital Mortality—30 Day (percent) • Statistical Rating for In-Hospital Mortality—30 Day	• Index hospitalization (one per member)[2] • Any hospitalization[4] ending in death where the death occurred no more than 30 days from the admit date of the index AMI hospitalization
		• Percent Receiving Diagnostic Catheterization Procedure	• Index hospitalization (one per member)[2] • Any hospitalization[4] in which a catheterization procedure was performed no more than 30 days from (or 3 days prior to) the date of admission of the index hospitalization
		• Percent Receiving PTCA/Stent Procedure • Percent Receiving Coronary Artery Bypass Graft (CABG) Procedure	• Index hospitalization (one per member)[2] • Any hospitalization[4] in which the procedure was performed no more than 30 days from the date of admission of the index hospitalization
	HEDIS	• Cholesterol Management after Acute Cardiovascular Events o Cholesterol Screening after Acute Cardiovascular Events (percent) o "Bad" Cholesterol Controlled after Acute Cardiovascular Events (percent) • Beta Blockers after a Heart Attack (percent)	Not Applicable

[1]Identifies the hospitalizations that were used to extract utilization and/or clinical information for the associated measure.
[2]Records with missing/invalid SSNs cannot be linked to a single member, and therefore were counted as separate members for the hospitalization rate. If records had matching valid social security numbers but had inconsistent birth dates or sex identifiers that could not be resolved, each record was counted as a single index hospitalization.
[3]Non-index hospitalization that may or may not have a principal diagnosis related to condition analyzed.
[4]May be an index or a non-index hospitalization. An Index hospitalization must have a principal diagnosis of AMI. A non-index hospitalization need not have a principal diagnosis for AMI, but must be classified as MDC 5.

Table 3. *Hospitalizations Used for Each Measure and Clinical Condition* continued

Condition	Data Source	Measure	Hospitalizations[1]
Hysterectomy	PHC4	• Total Hysterectomy Hospital Admissions • Procedure Rate per 10,000 Female Members (age-adjusted) • Statistical Rating for Procedure Rate *Abdominal and Vaginal reported separately:* • Number of Hospital Admissions • Procedure Rate per 10,000 Female Members (age-adjusted) • Statistical Rating for Procedure Rate • Length of Stay (risk-adjusted) • Expected In-Hospital Complications (risk-adjusted; percent) • Actual In-Hospital Complications (percent) • Statistical Rating for In-Hospital Complications	• Index hospitalization only (one per member)[2]
	HEDIS	• Screening for Cervical Cancer (percent)	Not Applicable
Breast Cancer Procedures	PHC4	• Total Breast Cancer Procedures • Procedure Rate per 10,000 Female Members (age-adjusted) *Lumpectomy and Mastectomy reported separately:* • Number of Procedures • Percent Performed Inpatient	• Single Encounters [3,4]
		• Length of Stay (risk-adjusted) • Expected In-Hospital Complications (risk-adjusted; percent) – reported for mastectomy only • Actual In-Hospital Complications (percent) – reported for mastectomy only • Statistical Rating for In-Hospital Complications – reported for mastectomy only *Mastectomy procedures reported:* • Percent of Mastectomies with Reconstruction During the Same Admission	• Single Hospitalizations (inpatient only)[4]
	HEDIS	• Screening for Breast Cancer (percent)	Not Applicable
Neck and Back Procedures	PHC4	• Total Neck and Back Procedures • Procedure Rate per 10,000 Members (age & sex-adjusted) *With Fusion and Without Fusion reported separately:* • Number of Procedures • Percent Performed Inpatient • Length of Stay (risk-adjusted) • Expected In-Hospital Complications (risk-adjusted; percent) • Actual In-Hospital Complications (percent) • Statistical Rating for In-Hospital Complications	• Single Encounters[3,4] • Single Hospitalizations (inpatient only)[4]
Prostatectomy	PHC4	• Total Prostatectomy Procedures • Procedure Rate per 10,000 Male Members (age-adjusted) • Length of Stay (risk-adjusted) • Expected In-Hospital Complications (risk-adjusted; percent) • Actual In-Hospital Complications (percent) • Statistical Rating for In-Hospital Complications	• Index hospitalization only (one per member)[2]

Table 3. *Hospitalizations Used for Each Measure and Clinical Condition* continued

Condition	Data Source	Measure	Hospitalizations[1]
Mental Health	HEDIS	• Antidepressant Medication Management o Members with At Least 3 Follow-Up Visits (percent) o Effective Acute Phase Treatment (percent) o Effective Continuation Phase Treatment (percent) • Follow-Up After Hospitalization for a Mental Health Condition o 7-Days (percent) o 30-Days (percent) • Members Receiving any Mental Health Service (percent) • Inpatient Admission Rate • Inpatient Hospitalization Average Length of Stay	Not Applicable
Other Measures	HEDIS	• Advising Smokers to Quit • Childhood Immunizations • Timely Initiation of Prenatal Care • Colorectal Cancer Screening	Not Applicable

[1]Identifies the hospitalizations that were used to extract utilization and/or clinical information for the associated measure.
[2]Records with missing/invalid SSNs cannot be linked to a single member, and therefore were counted as separate members for the hospitalization rate. If records had matching valid social security numbers but had inconsistent birth dates or sex identifiers that could not be resolved, each record was counted as a single index hospitalization.
[3] Encounter refers to a single patient visit, not number of procedures (i.e., if a patient had both a lumpectomy and a mastectomy in the same medical visit, only the more invasive procedure was counted as a single patient encounter).
[4]Over the course of the study period, a single patient may have more than one hospitalization for said condition. If so, all of the single hospitalizations were analyzed.

RISK ADJUSTMENT METHODOLOGY

Risk Adjustment Approach for Hospitalization/Procedure Rates

Age and Sex Adjustment

Hospitalization and procedure rates are age and sex adjusted to account for differences in the mix of members (by sex or age) in one HMO plan compared to another. For example, older populations often experience more health problems. When this is true, PHC4's system "expected" more health problems in the HMO with an older population and made appropriate adjustments. Sex is often an important risk factor, therefore the system also accounted for differences among HMOs in this category. The hospitalization rate data were adjusted using age and sex cohorts derived from the total membership population of each HMO. These cohorts were constructed with the assistance and review of each HMO. The age cohorts used in the risk adjustment of hospitalization/procedure rates are described in Appendix D.

To standardize hospitalization/encounter data across plans and across age categories, only records for those patients age 64 or younger as of December 31, 2004 were included in the analysis. HMO members were excluded from an analysis if they turned 65 at any point during 2004, even if the individual was age 64 at the time of their hospitalization. Likewise, in conditions involving adults only, records were included for patients who were 18 years or older as of December 31, 2004. As part of the data verification process, HMOs were instructed to follow this same age criterion when adding records to the file of verified data. (Note that diabetes records were included if the patient was 18 years or older and 75 years or younger as of December 31, 2004 and excluded if the patient turned 76 at any time during the 2004 calendar year even if the patient was 75 at the time of the hospitalization.)

Calculation of Adjusted Hospitalization/Procedure Rates

Indirect standardization, using the risk factors of age and sex, was used to compare the hospitalization rates for each HMO plan against the hospitalization rate for the HMO aggregate for each clinical condition (see the "Statistical Ratings" section.) Because enrollment data were not collected from the insurance groups that comprise the "fee-for-service" sample, hospitalization rates cannot be reported for this sample.

Risk Adjustment Approach for Outcome Measures

Regression techniques were used to construct "risk-adjustment models" for length of stay, rehospitalizations–180 days, in-hospital mortality–30 day, and in-hospital complications. These models were used to calculate expected (predicted) results. HMO plans whose membership was characterized by a greater number of risk factors (e.g., severity of illness, comorbidity, demographic factors, socioeconomic factors, etc.) were given "credit" in the system; patients with significant risk factors were expected to have longer lengths of stay and a greater probability of rehospitalization, death, and/or complications.

The first step in building the risk adjustment models was to identify possible risk-adjustment factors—those factors that potentially contribute to a particular event for a particular condition. In doing so, both clinical and demographic factors identified in the literature were considered. The *Atlas Outcomes*^{TM} Predicted Probability of Death (MQPredDeath) and Predicted Length of Stay (MQPredLOS) scores were also considered. The process for gathering and reporting the Atlas information is explained in the following section.

Atlas Outcomes™ Approach for Risk Adjustment

In a contractual agreement with MediQual Systems®, Inc., a business of Cardinal Health in Marlborough, Massachusetts, acute care hospitals are required to use MediQual's *Atlas Outcomes™* Severity of Illness System to assess each patient's condition from date of admission through the first two days of the hospital stay (or a maximum of 30 hours, based on when the patient was admitted to the hospital). This system represents a summarization of patient risk/severity, characterized as scores such as predicted probability of death (MQPredDeath) or predicted length of stay (MQPredLOS). These scores, determined from objective data abstracted from medical records, were included as potential risk factors in this report. The MQPredDeath is derived from a logistic regression model and has a value from 0.000 to 1.000. The MQPredLOS is derived from a linear regression model and has no bounds.

The *Atlas Outcomes™* system is based on the examination of numerous Key Clinical Findings (KCFs) such as lab tests, EKG readings, vital signs, the patient's medical history, imaging results, pathology, age, sex, and operative/endoscopy findings. Hospital personnel abstract these KCFs during specified timeframes in the hospitalization. Some pre-admission data are also captured (e.g., cardiac catheterization findings), as are some history findings. The KCF results are entered into algorithms that calculate the overall predicted probability of death or the predicted length of stay.

PHC4 Model Selection

Model selection identified those candidate variables that were statistically significant predictors of the relevant event (i.e., length of stay, rehospitalization–180 day, in-hospital mortality–30 day, or in-hospital complication). Linear regression models were used for length of stay, while binary logistic regression models were used for rehospitalization, mortality, and complication outcomes. Forward stepwise model selection methods were used to determine the significant risk factors. Factors were included in the model if they met the $p < 0.10$ significance criteria. Evaluation of model performance for linear regression models was accomplished by considering the R-squared (R^2) values. The measures of model adequacy applied to the binary logistic regression models included the percentage explained, R^2, and the ROC area.

PHC4 Model Coefficients

The coefficients associated with the significant risk factors and their p-values are listed in the following table. (See Appendix D for descriptions of the variables.)

Table 4. Coefficients of Significant Predictors

Significant Predictors	Coefficient	p-value
COPD		
Length of Stay		
• Intercept	-1.0780	
• Age	0.0426	<.0001
• MQPredLOS[1]	0.5677	<.0001
Rehospitalization		
• Intercept	-1.8495	
• MQPredLOS[1]	0.2138	0.0017
• Median Household Income	-0.0119	0.0602
Pediatric Asthma		
Length of Stay		
• Intercept	0.9827	
• MQPredLOS[1]	0.2994	<.0001
• Age	0.0348	<.0001
• Female[4]	0.1981	0.0024
Adult Asthma		
Length of Stay		
• Intercept	0.2026	
• MQPredLOS[1]	0.5154	<.0001
• Chronic Obstructive Asthma[4]	0.5459	<.0001
• Psychological Disorder[4]	0.4195	0.0003
• Asthma with Status Asthmaticus[4]	0.4386	0.0025
• Female	0.3176	0.0025
• Age	0.0096	0.0426
Rehospitalization		
• Intercept	-2.7181	
• MQPredLOS[1]	0.2345	0.0005
• Asthma with Status Asthmaticus[4]	0.4918	0.0395
• Median Household Income	-0.0121	0.0261
• Chronic Obstructive Asthma[4]	0.2579	0.0766
Diabetes		
Length of Stay		
• Intercept	0.4808	
• MQPredLOS[1]	0.6539	<.0001
• Amputation	2.7346	<.0001
• Renal Dialysis	1.2431	0.0003
• Female[4]	0.3743	0.0061
• Heart Failure	0.6726	0.0129
• Diabetes Complications - Long Term	-0.3474	
• Diabetes Complications - None	-0.2891	0.0698
• Diabetes Complications - Short Term	0.0000	
Rehospitalization		
• Intercept	-2.6225	
• MQPredLOS[1]	0.1888	<.0001
• Age	-0.0298	<.0001
• Female	0.4855	0.0018
• Psychological Disorder	0.5855	0.0065
• Peripheral Vascular Disease	0.8420	0.0160
• Medical DRG	0.6994	0.0149
• Long Term Diabetes Complications	0.4393	0.0176

Significant Predictors	Coefficient	p-value
Heart Attack		
Length of Stay		
• Intercept	0.2178	
• MQPredLOS[1]	0.7316	<.0001
• Heart Failure[4]	2.6331	<.0001
• Age	0.0324	<.0001
• Diabetes	0.4441	0.0002
• Female	0.3886	0.0006
• Poverty Rate	1.8236	0.0048
• Alcohol/Drug Abuse	0.4821	0.0286
Mortality		
• Intercept	-0.8578	
• Logit of MQ PredDeath[5]	0.9252	<.0001
• Renal Dialysis[4]	0.9127	0.0008
• AMI Type I (Q Wave)[4]	0.4442	0.0016
• Heart Failure	0.3454	0.0166
Abdominal Hysterectomy		
Length of Stay		
• Intercept	0.9670	
• MQPredLOS[1]	0.7418	<.0001
• Poverty Rate	1.4803	<.0001
• Radical	0.5459	0.0111
• Age	-0.0249	0.0332
• Age Squared	0.0002	0.0553
In-Hospital Complications		
• Intercept	-4.6387	
• MQPredLOS[1]	0.7298	<.0001
• Poverty Rate	1.1364	0.0026
Vaginal Hysterectomy		
Length of Stay		
• Intercept	0.5512	
• MQPredLOS[1]	0.4755	<.0001
• Laparoscopic Procedure[4]	-0.2646	<.0001
• Age	0.0061	<.0001
• Poverty Rate	0.8176	<.0001
• PDxGrp[3] - Bleeding/Other PDx	-0.0729	0.0013
• PDxGrp[3] -Fibroids/Hyperplasia/etc.	0.0000	
In-Hospital Complications		
• Intercept	-4.4085	
• MQPredLOS[1]	1.3326	<.0001
• Age	-0.0187	0.0030
• Laparoscopic Procedure	-0.2929	0.0096
Lumpectomy		
Length of Stay		
• Intercept	-0.6603	
• MQPredLOS[1]	0.6358	<.0001
• Poverty Rate	1.1892	0.0046
• Breast Cancer Type - In Situ	0.1138	
• Breast Cancer Type - Malignant Neoplasm	0.2020	0.0352
• Breast Cancer Type - Metastatic Cancer	0.0000	
• Age	0.0095	0.0518

Table 4. *Coefficients of Significant Predictors* continued

Significant Predictors	Coefficient	p-value
Mastectomy		
Length of Stay		
• Intercept	0.8192	
• Reconstruction - Concurrent[4]	1.9978	<.0001
• MQPredLOS[1]	0.4776	<.0001
• Diabetes[4]	0.3934	0.0005
In-Hospital Complications		
• Intercept	-4.0473	
• Reconstruction - Concurrent[4]	1.1657	<.0001
• MQPredLOS[1]	0.3552	0.0158
Neck and Back Procedure With Fusion		
Length of Stay		
• Intercept	3.0542	
• Location – Cervical/Atlas-Axis	-1.8548	<.0001
• Location – Dorsal and Dorslumbar	1.6987	
• Location – Lumbar and Lumbosacral	0.0000	
• MQPredLOS[1]	0.5996	<.0001
• PDxGroup[3] – Disc Degeneration	-0.4095	<.0001
• PDxGroup[3] – Disk Displacement	-0.5577	
• PDxGroup[3] – Narrow Spinal Canal	-0.3143	
• PDxGroup[3] – Other Disk Disorders	0.0000	
• Poverty Rate	1.7048	<.0001
• Alcohol/Drug Abuse[4]	0.9166	<.0001
• Age	-0.0348	0.0705
• Age Squared	0.0004	0.0399
In-Hospital Complications		
• Intercept	-2.4706	
• Location – Cervical/Atlas-Axis	-1.4073	<.0001
• Location – Dorsal and Dorslumbar	0.8590	
• Location – Lumbar and Lumbosacral	0.0000	
• MQPredLOS[1]	0.2605	<.0001
• PDxGroup[3] – Disc Degeneration	-0.2644	0.0207
• PDxGroup[3] – Disk Displacement	-0.5648	
• PDxGroup[3] – Narrow Spinal Canal	-0.2750	
• PDxGroup[3] – Other Disk Disorders	0.0000	
• PxGroup[2] – Both	0.6341	0.0624
• PxGroup[2] - Discectomy	0.0865	
• PxGroup[2] - Laminectomy	0.0000	
• Female	-0.2366	0.0357
• Obesity	0.3640	0.0705
• Age	0.0119	0.0632
• Median Household Income	-0.0088	0.0568

Significant Predictors	Coefficient	p-value
Neck and Back Procedure Without Fusion		
Length of Stay		
• Intercept	-0.1643	
• MQPredLOS[1]	0.9997	<.0001
• PDxGroup[3] – Disc Degeneration	-0.5475	<.0001
• PDxGroup[3] – Disk Displacement	-0.7000	
• PDxGroup[3] – Narrow Spinal Canal	-0.3878	
• PDxGroup[3] – Other Disk Disorders	0.0000	
• Poverty Rate	1.5271	<.0001
• Female[4]	-0.1252	<.0001
• PxGroup[2] – Both	0.1104	0.0735
• PxGroup[2] – Discectomy	-0.0193	
• PxGroup[2] - Laminectomy	0.0000	
• Age	0.0238	0.0112
• Age Squared	-0.0003	0.0040
In-Hospital Complications		
• Intercept	-3.4317	
• PDxGroup[3] – Disc Degeneration	0.2143	<.0001
• PDxGroup[3] – Disk Displacement	-0.6460	
• PDxGroup[3] – Narrow Spinal Canal	-0.1110	
• PDxGroup[3] – Other Disk Disorders	0.0000	
• MQPredLOS[1]	0.2802	0.0001
• Age	0.0124	0.0187
• Median Household Income	-0.0069	0.0656
Prostatectomy		
Length of Stay		
• Intercept	2.3857	
• MQPredLOS[1]	0.3123	<.0001
• Hypertension[4]	0.1566	0.0187
• Median Household Income	-0.0116	<0.001
In-Hospital Complications		
• Intercept	-4.6478	
• MQPredLOS[1]	0.5633	0.0001
• Poverty	3.2853	0.0015

[1] Atlas Outcomes ™ Predicted Length of Stay
[2] Procedure Group
[3] Principal Diagnosis Group
[4] These factors were tested as binary variables.
[5] Atlas Outcomes™ Predicted Probability of Death

Calculation of Risk-Adjusted Outcomes

Actual and expected rates and statistical ratings (greater than expected, as expected, or less than expected) were calculated for length of stay, rehospitalizion – 180 day, in-hospital mortality—30 day, and/or in-hospital complications for each appropriate clinical condition. The expected rate was based on the risk factors of the hospitalizations included. Actual and expected rates could then be compared to determine if differences were statistically significant.

Determining Actual (Observed) Rates

Length of Stay	This value was determined as the arithmetic mean length of stay for the hospitalizations included for a particular condition.
Percent Rehospitalized	This rate was determined by dividing the total number of members rehospitalized (at least once) to a general or specialty acute care hospital within 180 days of discharge (from the last hospitalization in the episode) by the total number of members hospitalized for that particular principal diagnoses.
In-Hospital Mortality *(Heart Attack only)*	This rate was determined by dividing the total number of patients who died in the hospital within 30 days of the admit date of the index heart attack hospitalization by the total number of patients hospitalized with a heart attack.
In-Hospital Complication	This rate was determined by dividing the total number of hospitalizations with at least one complication by the total number of hospitalizations included for that particular condition.

Determining Expected Rates

The models for each outcome used the risk factor values and corresponding coefficients to provide a predicted value (predicted length of stay, probability of rehospitalization, predicted probability of death, or probability of complication) for each observation after exclusions. The expected rate for an individual HMO plan was the average of these predicted values for all observations associated with the plan.

For both the linear and logistic regression models, the first step to determine these predicted values was to multiply the vector of model coefficients (ß) by the vector of risk factors (X). This value, ßX, is calculated for each patient and equals:

$$ßX, = ß_0 + ß_1x_1 + ß_2x_2 + ß_3x_3 \ldots$$

where

$ß_n$ = the relevant model coefficient (see Table 4; $ß_0$ is the intercept)
X_n = the value of the risk factor for this patient

(risk factors that are binary, i.e., yes/no, were coded as yes = 1 and no =0)

For linear models, the value ßX was the final predicted value. For logistic models, the predicted value was calculated as:

$$p = \frac{e^{ßX}}{1 + e^{ßX}}$$

where e ≈ 2.7182818285

Linear Example – Calculations Used in COPD Length of Stay (LOS)

Total Cases: Number of hospitalizations after exclusions (equal to n).

Actual Length of Stay: Mean of the length of stay for each hospitalization.

Expected Length of Stay: Mean of the predicted length of stay for each hospitalization.

Step 1: Calculate each patient's predicted length of stay (PLOS):

$$\begin{aligned} PLOS &= ßX \\ &= ß_0 + ß_1x_1 + ß_2x_2 \\ &= -1.0780 + (0.0426)(x_1) + (0.\ 5677)(x_2) \end{aligned}$$

where
- x_1 = Patient Age in Years
- x_2 = MediQual PredLOS value

(ß's can be found in Table 4.)

Step 2: Calculate the mean PLOS for an HMO plan:

$$\text{Mean PLOS} = \frac{\Sigma\ \text{PLOS}}{n}$$

Risk-Adjusted Length of Stay: $\frac{\text{Mean Actual LOS}}{\text{Mean PLOS}}\left(\text{Mean Actual LOS for the HMO and FFS databases combined}\right)$

Logistic Example – Calculations used in COPD Percent Rehospitalized

Total Cases: Number of hospitalizations after exclusions (equal to n).

Actual Percent Rehospitalized: Total number of members rehospitalized at least once / total number of hospitalizations.

Predicted Percent Rehospitalized: Mean of the predicted probability of rehospitalization for each hospitalization.

Step 1: Calculate each patient's predicted rehospitalization percent (PRehosp):

$$\begin{aligned} ßX &= ß_0 + ß_1x_1 + ß_2x_2 \\ &= -1.8495 + (0.2138)(x_1) + (-0.0119)(x_2) \end{aligned}$$

where
- x_1 = MediQual PredLOS value
- x_2 = Median Household Income

(ß's can be found in Table 4.)

$$\text{PRehosp} = \frac{e^{\beta X}}{1+e^{\beta X}}$$

Step 2: Calculate the mean PRehosp for an HMO plan:

$$\text{Mean PRehosp} = \frac{\Sigma\ \text{PRehosp}}{n}$$

Statistical Ratings

Significance tests (using binomial distribution) were performed for the measures listed in the table below.

Table 5. *Binomial Distribution, by Measure*

Measure	Clinical Conditions
Hospitalization Rate (Members hospitalized for a given clinical condition per HMO population)	Ear, Nose and Throat Infections; High Blood Pressure; Gastrointestinal Infections; Kidney/Urinary Tract Infections; Chronic Obstructive Pulmonary Disease; Asthma; Diabetes
Procedure Rate (Members hospitalized for a hysterectomy)	Hysterectomy
In-Hospital Mortality (Death vs. No Death)	Heart Attack
In-Hospital Complications (Complication vs. No Complication)	Hysterectomy; Breast Cancer Procedures; Neck and Back Procedures; Prostatectomy
Percent Rehospitalized (Rehospitalized vs. Not Rehospitalized)	COPD; Adult Asthma; Diabetes

Although the measures for any single HMO plan may be comparable to the statewide norm (or HMO aggregate), random variation plays a role in such comparisons. Statistical evaluation was used to determine whether the difference between the observed and the expected (or average) value was *too large* to be attributed solely to chance.

Binomial Distribution

The use of binomial distribution required the following assumptions:

- each observation included in the study had one of two observable events (e.g., in-hospital complication vs. no in-hospital complication). In other words, the response was dichotomous.
- the probability of the event (e.g., having a complication) for each observation studied within a clinical condition group was equal to the probability provided by the risk models.
- the result for any one observation in the analyses had no impact on the result of another observation. In other words, the observations were independent.

The probability distributions were based on the HMO plans' predicted or expected rates. Using the probability distribution, a p-value was calculated for each observed value. This p-value is the probability, or likelihood, that the observed value could have occurred by chance. If it was very unlikely ($p < 0.05$; see "Inferential Error" section below) that the observed value could have occurred only by chance, then it was concluded that the observed value was "significantly different" from the expected value.

Calculation of p-values

Calculating the p-value for the binomial test is defined by a formula that sums discrete probabilities based upon the binomial distribution. The binomial formula (see below) was used, in part, to derive the p-value. The probability that a binomial random variable takes on a specific value is defined by the following equation (i.e., the binomial formula):

$$P(X=a) = [(N!)/(a!(N-a)!)]\ p^{a}(1-p)^{N-a}$$

where (for in-hospital complications analysis),

P(X=a) is the probability that the binomial random variable (X) takes on a specific value (a); that is, a = 1 hospitalization with complication, a = 2 hospitalizations with complications, etc.

X is the binomial random variable. X is a discrete random variable that can range from 0 through N ($0 \leq X \leq N$).

N is the number of observations for a particular HMO plan's clinical condition.

p is the overall expected probability of patient in-hospital complications for a particular HMO plan's clinical condition.

The p-value for a specific result is determined to be the sum of all probabilities associated with that result and all other results that are more extreme. The p-value associated with the observed number of in-hospital complications was calculated for each HMO plan and clinical condition.

Inferential Error

A type of inferential error that can be made in statistics is called a Type I error or "false positive." The probability of committing a Type I error is equal to the level of significance established by the researcher. For the current analysis, the level of significance was set to 0.05. In the context of the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, a Type I error occurred when the difference between the observed in-hospital complications percent and the expected in-hospital complications percent was declared statistically significant, when in fact, the difference was due to chance. That is, for a particular clinical condition, the HMO plan was declared to be statistically higher or lower than expected, when in reality the HMO plan's level of performance was comparable to the statewide norm. Since the level of significance was set to 0.05, there was a 5% (or 1 in 20) chance of committing this type of error.

Assignment of Statistical Rating

A statistical rating was assigned to each HMO if the difference between what was observed and what was expected in a particular clinical condition was statistically significant. The p-value, calculated in terms of a "two-tailed" test was compared to the level of significance. For example, in the calculation of in-hospital complications percent for each HMO:

- if the calculated p-value was greater than or equal to 0.05, then the conclusion was made that the difference between what was expected and what was observed was *not* statistically significant. It *cannot be concluded* that the in-hospital complications percent for that particular clinical condition in that particular HMO was different from the comparative reference.

- if the calculated p-value was less than 0.05, then the conclusion was made that the difference between what was expected and what was observed *was* statistically significant.

- If the observed in-hospital complications percent was lower than expected, which was based on the statewide in-hospital complications percent, the HMO was assigned the symbol "○" (as shown in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report) to indicate the in-hospital complications percent was significantly lower than expected for a particular clinical condition.

- If the observed in-hospital complications percent was higher than expected, which was based on the statewide in-hospital complications percent, the HMO was assigned the symbol "●" (as shown in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report) to indicate the in-hospital complications percent was significantly higher than expected for a particular clinical condition.

In the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, statistical ratings are shown for HMO plans that have sufficient records. When the number of records for analysis was less than 10, "NR" (Not Reported) is displayed (except for analyses related to the rate of hospitalizations or procedures).

Treatment Measures Calculated by PHC4

PREVENTING HOSPITALIZATION THROUGH PRIMARY CARE

Pediatric Ear, Nose and Throat Infections

Inclusion Criteria

Cases were included in the data analysis for pediatric ear, nose, and throat infections if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." Pediatric HMO members included in this analysis were 0 through 17 years of age. A total of 408 admissions, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of pediatric index hospitalizations per 10,000 pediatric members. Of the 428 hospitalizations for pediatric ear, nose, and throat infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 20 records were excluded. These hospitalizations are listed in Table 6A. The HMO database was used as the comparative reference.

Table 6A. *Exclusions from "Hospitalization Rate" Analysis for Pediatric Ear, Nose and Throat Infections*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*428*	*100.0*
Exclusions:		
❖ Neonate (age < 28 days)	12	2.8
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	1	0.2
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	0	0.0
❖ Mechanical Ventilation*	4	0.9
❖ Tracheitis*	2	0.5
❖ Metastatic Cancer; Ear, Nose, and Throat Cancer; Lung Cancer; HIV Infection; Tracheostomy; Cleft Lip and Palate Repair*	1	0.2
Total exclusions	*20*	*5.4*
Total members remaining in analysis	*408*	*94.6*

*See Appendix B for definitions of clinically complex exclusions.

Adult Ear, Nose and Throat Infections

Inclusion Criteria

Cases were included in the data analysis for adult ear, nose, and throat infections if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." Adult HMO members included in this analysis were 18 through 64 years of age. A total of 468 admissions, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of adult index hospitalizations per 10,000 adult members. Of the 491 hospitalizations for adult ear, nose, and throat infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 23 records were excluded.

These hospitalizations are listed in Table 6B. The HMO database was used as the comparative reference.

Table 6B. *Exclusions from "Hospitalization Rate" Analysis for Adult Ear, Nose and Throat Infections*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	491	100.0
Exclusions:		
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	6	1.2
❖ Metastatic Cancer*	2	0.4
❖ HIV Infection*	1	0.2
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	1	0.2
❖ Mechanical Ventilation*	7	1.4
❖ Tracheostomy*	3	0.6
❖ Ear, Nose, and Throat Cancer; Lung Cancer; Cleft Lip and Palate Repair; Tracheitis*	3	0.6
Total exclusions	*23*	*4.7*
Total members remaining in analysis	*468*	*95.3*

*See Appendix B for definitions of clinically complex exclusions.

High Blood Pressure (Hypertension)

Inclusion Criteria

Only adult (18 through 64 years of age) HMO members were included in this analysis. Cases were included in the data analysis for high blood pressure if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." A total of 542 admissions, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of index hospitalizations per 10,000 adult members. Of the 586 hospitalizations for hypertension submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 44 records were excluded. These hospitalizations are listed in Table 6C. The HMO database was used as the comparative reference.

Table 6C. *Exclusions from "Hospitalization Rate" Analysis for High Blood Pressure*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*586*	*100.0*
Exclusions:		
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	29	4.9
❖ Metastatic Cancer*	1	0.2
❖ Renal Dialysis*	3	0.5
❖ Open Heart Surgery*	1	0.2
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	5	0.9
❖ PTCA/Stent*	3	0.5
❖ HIV Infection; Mechanical Ventilation; Tracheostomy*	2	0.4
Total exclusions	*44*	*7.5*
Total members remaining in analysis	*542*	*92.5*

*See Appendix B for definitions of clinically complex exclusions.

Gastrointestinal Infections

Inclusion Criteria

Cases were included in the data analysis for gastrointestinal infections if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." HMO members included in this analysis were 0 through 64 years of age. A total of 1,062 admissions, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of index hospitalizations per 10,000 members. Of the 1,116 hospitalizations for gastrointestinal infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 54 records were excluded. These hospitalizations are listed in Table 6D. The HMO database was used as the comparative reference.

Table 6D. *Exclusions from "Hospitalization Rate" Analysis for Gastrointestinal Infections*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*1,116*	*100.0*
Exclusions:		
❖ Neonate (age < 28 days)	4	0.4
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	22	2.0
❖ Gastrointestinal Cancer*	12	1.1
❖ Metastatic Cancer*	4	0.4
❖ HIV Infection*	1	0.1
❖ Extensive OR Procedures Unrelated to Principal Diagnosis*	1	0.1
❖ Major Large and Small Bowel Procedures*	7	0.6
❖ Other Digestive System OR Procedures with Complications*	3	0.3
Total exclusions	*54*	*4.8*
Total members remaining in analysis	*1,062*	*95.2*

*See Appendix B for definitions of clinically complex exclusions.

Kidney/Urinary Tract Infections

Inclusion Criteria

Cases were included in the data analysis for kidney/urinary tract infections if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." HMO members included in this analysis were 0 through 64 years of age. A total of 1,304 records, after exclusions, matched these criteria.

Hospitalization Rate and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate shown for each HMO used the total number of index hospitalizations per 10,000 members. Of the 1,508 hospitalizations for kidney/urinary tract infections submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 204 records were excluded. These hospitalizations are listed in Table 6E. The HMO database was used as the comparative reference.

Table 6E. *Exclusions from "Hospitalization Rate" Analysis for Kidney/Urinary Tract Infections*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*1,508*	*100.0*
Exclusions:		
❖ Neonate (age < 28 days)	8	0.5
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	71	4.7
❖ Metastatic Cancer*	36	2.4
❖ Kidney/Urinary Tract Cancer*	6	0.4
❖ HIV Infection*	2	0.1
❖ Chronic Renal Failure*	11	0.7
❖ Renal Dialysis*	11	0.7
❖ Cases in DRGs Unrelated to Kidney/Urinary Tract Infections *	59	3.9
Total exclusions	*204*	*13.5*
Total members remaining in analysis	*1,304*	*86.5*

*See Appendix B for definitions of clinically complex exclusions and DRGs used to define Kidney/Urinary Tract Infections.

MANAGING ON-GOING ILLNESSES

Chronic Obstructive Pulmonary Disease (COPD)

Inclusion Criteria

Only adult (18 through 64 years of age) HMO members were included in this analysis. Cases were included in the data analysis for COPD if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." A total of 857 admissions, after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate is shown for each HMO using the total number of index hospitalizations per 10,000 adult HMO members. Of the 1,089 hospitalizations for COPD submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 232 records were excluded. These hospitalizations are listed in Table 7A. The HMO database was used as the comparative reference.

Table 7A. *Exclusions from "Hospitalization Rate" Analysis for COPD*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*1,089*	*100.0*
Exclusions:		
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	158	14.5
❖ Cases in DRGs Unrelated to COPD*	51	4.7
❖ Metastatic Cancer*	12	1.1
❖ Lung Cancer*	11	1.0
❖ HIV Infection*	0	0.0
❖ Mechanical Ventilation; Tracheostomy*	0	0.0
Total exclusions	*232*	*21.3*
Total members remaining in analysis	*857*	*78.7*

*See Appendix B for definitions of clinically complex exclusions and DRGs used to define COPD.

Length of Stay (risk-adjusted). The inpatient length of stay measure was calculated from the COPD index hospitalization only, beginning with the date of admission and ending with the date of discharge of the index hospitalization (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the risk-adjusted length of stay analysis for

COPD are listed in Table 7B. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7B. *Exclusions from "Length of Stay" (LOS) Analysis for COPD*

	Total HMO and Fee-for-Service Hospitalizations		
	N	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	*1,502*	*100.0*	*4.5*
Exclusions:			
❖ Hospitalization Rate Exclusions	316	21.0	6.7
❖ Death in Hospital	6	0.4	5.0
❖ Missing *Atlas Outcomes™* Score	6	0.4	4.8
❖ Outlier[1]/Missing or Invalid[2] LOS	6	0.4	18.5
Total exclusions	*334*	*22.2*	*6.9*
Total members remaining in analysis	*1,168*	*77.8*	*3.9*

[1]LOS values that were > 15 days.
[2]LOS value < 0.

Rehospitalizations (risk-adjusted). To calculate the percent rehospitalized, the first return hospitalization for respiratory-related acute care (MDC 4) within 180 days of discharge from an acute care facility in Pennsylvania was used. For multiple-hospitalization episodes, the discharge date of the last hospitalization (which may not be COPD-related) in the COPD episode was used as the start point for counting the 180 days. If a member was rehospitalized multiple times, he or she was still counted as one member who was rehospitalized. Exclusions are listed in Table 7C. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7C. *Exclusions from "Rehospitalizations" Analysis for COPD*

	Total HMO and Fee-for-Service Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*1,502*	*100.0*
Exclusions:		
❖ Length of Stay Exclusions	334	22.2
❖ Patient was transferred and died in hospital	0	0.0
❖ Non-PA Resident	19	1.3
❖ Invalid Social Security Number	7	0.5
❖ Invalid Admit Date/Discharge Date/Birth Date/Sex	0	0.0
Total exclusions	*360*	*24.0*
Total members remaining in analysis	*1,142*	*76.0*

Pediatric and Adult Asthma

Inclusion Criteria

Pediatric (0 through 17 of age) and adult (18 through 64 years of age) cases were analyzed separately. HMO cases were included in the data analysis if they included as a principal diagnosis one of the ICD-9-CM codes listed under this condition in Appendix A: "Description of Study Population." A total of 1,172 pediatric admissions and 1,627 adult admissions, after exclusions, matched these criteria.

Utilization/ Outcome Measures and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate is shown for each HMO using the total number of asthma index hospitalizations per 10,000 pediatric/adult members. Of the 1,228 pediatric hospitalizations for asthma submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 56 records were excluded. Of the 1,903 adult hospitalizations submitted, 276 records were excluded. These hospitalizations are listed in Table 7D. The HMO database was used as the comparative reference.

Table 7D. *Exclusions from "Hospitalization Rate" Analyses for Asthma*

	Total HMO Hospitalizations			
	Pediatric		*Adult*	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations before exclusions	*1,228*	*100.0*	*1,903*	*100.0*
Exclusions:				
❖ Neonate (age < 28 days)	0	0.0	NA	NA
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	55	4.5	246	12.9
❖ HIV Infection*	0	0.0	0	0.0
❖ Metastatic Cancer*	0	0.0	4	0.2
❖ Lung Cancer*	0	0.0	2	0.1
❖ Tracheostomy*	0	0.0	0	0.0
❖ Mechanical Ventilation*	1	0.1	24	1.3
Total exclusions	*56*	*4.6*	*276*	*14.5*
Total members remaining in analysis	*1,172*	*95.4*	*1,627*	*85.5*

*See Appendix B for definitions of clinically complex exclusions.
NA: Not Applicable

Length of Stay (risk-adjusted). Length of stay was calculated from the asthma index hospitalization only, beginning with the date of admission and ending with the date of discharge of the index hospitalization (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the risk-adjusted length of stay analysis for asthma are listed in Table 7E. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7E. *Exclusions from "Length of Stay" (LOS) Analyses for Asthma*

	Total HMO and Fee-for-Service Hospitalizations					
	Pediatric			*Adult*		
	N	*% of Total*	*Avg. LOS*	*N*	*% of Total*	*Avg. LOS*
Total hospitalizations before exclusions	*1,477*	*100.0*	*2.0*	*2,386*	*100.0*	*3.5*
Exclusions:						
❖ Hospitalization Rate Exclusions	64	4.3	2.4	322	13.5	4.8
❖ Death in Hospital	0	0.0	NA	1	<0.1	3.0
❖ Missing *Atlas Outcomes*^{TM} Score	9	0.6	2.2	18	0.8	3.4
❖ Outlier[1]/Missing or Invalid[2] LOS	2	0.1	16.5	6	0.3	21.5
Total exclusions	75	5.1	2.8	*347*	*14.5*	*5.0*
Total members remaining in analysis	*1,402*	*94.9*	*2.0*	*2,039*	*85.5*	*3.3*

[1]LOS values that were > 10 days for pediatric asthma and > 15 days for adult asthma.
[2]LOS value < 0.
NA: Not Applicable

Rehospitalizations (risk-adjusted). The percent rehospitalized was calculated for adult asthma only. Because pediatric cases frequently lack social security number identification, potential rehospitalizations cannot be linked to previous hospitalizations. Thus, the rehospitalization analysis was not performed for pediatric asthma cases.

To calculate the percent rehospitalized, the first return hospitalization for respiratory-related acute care (MDC 4) within 180 days of discharge from an acute care facility in Pennsylvania was used. For multiple-hospitalization episodes, the discharge date of the last hospitalization (which may not be asthma-related) in the asthma episode was used as the start point for counting the 180 days. If a member was rehospitalized multiple times, he or she was still counted as one member who was rehospitalized. Exclusion criteria for rehospitalizations are listed in Table 7F. The HMO and the fee-for-service combined database were used as the comparative reference.

Table 7F. *Exclusions from "Rehospitalizations" Analysis for Adult Asthma*

	Total HMO and Fee-for-Service Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*2,386*	*100.0*
Exclusions:		
❖ Length of Stay Exclusions	347	14.5
❖ Patient was transferred and died in hospital	0	0.0
❖ Non-PA Resident	38	1.6
❖ Invalid Social Security Number	16	0.7
❖ Invalid Admit Date/Discharge Date/Birth Date/Sex	0	0.0
Total exclusions	*401*	*16.8*
Total members remaining in analysis	*1,985*	*83.2*

Diabetes

Inclusion Criteria

Hospitalizations for HMO members (18 through 75 years of age) were included in this analysis only if: 1) the member was identified as having diabetes according to HEDIS NCQA guidelines, 2) met continuous enrollment requirements set by NCQA, and 3) the hospitalization had a principal diagnosis of diabetes (ICD-9-CM codes are listed in Appendix A: *Description of Study Population).* Note that the age interval for this analysis is different from the other clinical treatments/conditions included in the report. A total of 1,199 admissions, after exclusions, were included in the hospitalization rate analysis.

Utilization/Outcome Measures and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate is shown for each HMO using the total number of adult HMO members with diabetes hospitalized per 10,000 diabetic members. Of the 1,698 hospitalizations for diabetes submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 499 records were excluded. These hospitalizations are listed in Table 7G. The HMO database was used as the comparative reference.

Table 7G. *Exclusions from "Hospitalization Rate" Analysis for Diabetes*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*1,698*	*100.0*
Exclusions:		
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	264	15.5
❖ Metastatic Cancer*	8	0.5
❖ HIV Infection*	1	< 0.1
❖ Major Organ Transplant*	23	1.4
❖ Cases in DRGs Unrelated to Diabetes*	203	12.0
Total exclusions	499	29.4
Total members remaining in analysis	*1,199*	*70.6*

*See Appendix B for definitions of clinically complex exclusions and DRGs used to define diabetes.

Length of Stay (risk-adjusted). Length of stay was calculated from the diabetes index hospitalization, beginning with the date of admission and ending with the date of discharge of the hospitalization (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the risk-adjusted length of stay analysis for diabetes are listed in the Table 7H. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7H. *Exclusions from " Length of Stay" (LOS) Analysis for Diabetes*

	Total HMO and Fee-for-Service Hospitalizations		
	N	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	*2,392*	*100.0*	*4.8*
Exclusions:			
❖ Hospitalization Rate Exclusions	708	29.6	6.5
❖ Death in Hospital	6	0.3	7.8
❖ Missing *Atlas Outcomes™* Scores	45	1.9	4.5
❖ Outlier[1]/ Missing or Invalid[2] LOS	7	0.3	46.7
Total exclusions	*766*	*32.0*	*6.8*
Total members remaining in analysis	*1,626*	*67.5*	*3.9*

[1]LOS values that were > 30 days.
[2]LOS value < 0.

Percent of Admissions for Short-Term Complications of Diabetes. For all diabetes hospitalizations included in the hospitalization rate analysis, PHC4 also calculated the percent that were hospitalized due to short-term complications of diabetes. These hospitalizations may be an immediate reflection of how well members are managing their diabetes. Short-term complications of diabetes are acute, life-threatening events related to blood sugar control. The following codes were used to identify short-term complications: 250.02, 250.03, 250.10-250.13, 250.20-250.23, 250.30-250.33.

Rehospitalizations (risk-adjusted). To calculate the percent rehospitalized, the first return hospitalization for diabetes-related acute care within 180 days of discharge from an acute care facility in Pennsylvania was used. For multiple-hospitalization episodes, the discharge date of the last hospitalization (which may not be diabetes-related) in the diabetes episode was used as the start point for counting the 180 days. If a member was rehospitalized multiple times, he or she was still counted as one member who was rehospitalized. Exclusion criteria for rehospitalizations are listed in Table 7I. The HMO and the fee-for-service combined database was used as the comparative reference.

Table 7I. *Exclusions from "Rehospitalizations" Analysis for Diabetes*

	Total HMO and Fee-for-Service Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*2,392*	*100.0*
Exclusions:		
❖ Length of Stay Exclusions	766	32.0
❖ Patient was transferred and died in hospital	0	0.0
❖ Non-PA Resident	37	1.5
❖ Invalid Social Security Number	13	0.5
❖ Invalid Admit Date/Discharge Date/Birth Date/Sex	0	0.0
Total exclusions	*816*	*34.1*
Total members remaining in analysis	*1,576*	*65.9*

HEART ATTACK (AMI)

Inclusion Criteria

Only adult (18 through 64 years of age) HMO members were included in this analysis. Cases that were assigned a principal diagnosis of one of the ICD-9-CM codes for heart attack (see Appendix A: "Description of Study Population") were included in the analyses. A total of 2,498 admissions, after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Hospitalization Rate (age and sex-adjusted). The hospitalization rate is shown for each HMO using the total number of AMI index hospitalizations per 10,000 adult members. Of the 2,928

hospitalizations for heart attack submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 430 records were excluded. These hospitalizations are listed in Table 8A. The HMO database was used as the comparative reference.

Table 8A. *Exclusions from "Hospitalization Rate" Analysis for Heart Attack*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*2,928*	*100.0*
Exclusions:		
❖ Case in which patient returned to the hospital after identified as having died	0	0.0
❖ Subsequent Hospitalization(s) (non-index) for the Same Person	415	14.2
❖ HIV Infection*	3	0.1
❖ Metastatic Cancer*	11	0.4
❖ Heart or Heart and Lung Transplant*	1	<0.1
Total exclusions	*430*	*14.7*
Total members remaining in analysis	*2,498*	*85.3*

*See Appendix B for definitions of clinically complex exclusions.

In-Hospital Mortality (risk-adjusted). Because the treatment of AMI is complex, a 30-day period is used to determine in-hospital mortality. In this analysis, the death must: 1) occur within the index AMI hospitalization itself or another acute care (MDC 5) hospitalization in the AMI episode, and 2) occur within 30 days of the admit date of the index AMI hospitalization. The exclusions to the analysis of in-hospital mortality for heart attack are listed below in Table 8B. The statewide database was used as the comparative reference.

Table 8B. *Exclusions from "In-Hospital Mortality" Analysis for Heart Attack*

	Total Statewide Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*13,496*	*100.0*
Exclusions:		
❖ Hospitalization Rate Exclusions	1,939	14.4
❖ Missing *Atlas Outcomes™* Score	127	0.9
❖ Invalid Social Security Number*	184	1.4
❖ Invalid Admit Date/Discharge Date/Birth Date/Sex*	1	<0.1
Total exclusions	*2,251*	*16.7*
Total members remaining in analysis	*11,245*	*83.3*

*Hospitalizations were excluded because it was indeterminable (due to invalid SSN, dates, sex, etc.) whether these patients were hospitalized (and died) at another time following the index AMI hospitalization.

Number of Days Hospitalized (risk-adjusted). Rather than reporting length of stay, the Number of Days hospitalized for individual heart attack patients is reported as an indicator of the time spent in the hospital(s) for heart attack treatment. The Number of Days hospitalized for heart attack patients consists of the total time spent in the hospital or the sum of individual MDC 5 hospitalizations that began no more than 30 days from the admit date of the index heart attack hospitalization. The exclusions to the Number of Days hospitalized analysis for heart attack are listed in Table 8C. The statewide database was used as the comparative reference.

Table 8C. *Exclusions from "Number of Days Hospitalized" Analysis for Heart Attack*

	Total Statewide Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*13,496*	*100.0*
Exclusions:		
❖ In-Hospital Mortality Exclusions	2,251	16.7
❖ Death in Hospital Within 30 Days[1]	319	2.4
❖ Death in Hospital After 30 Days but Within an AMI Episode[2]	28	0.2
❖ Outliers[3]/Missing or Invalid[4] LOS	75	0.6
Total exclusions	*2,673*	*19.8*
Total hospitalizations remaining in analysis	*10,823*	*80.2*

[1]Refers to a death that occurs within 30 days of the admission date of the index hospitalization.
[2]Refers to a death that occurs beyond 30 days of the admission date of the index hospitalization.
[3]Hospitalizations in which days hospitalized > 45.
[4]LOS value < 0.

Other Cardiac Procedures Associated with Any Single Heart Attack Patient

The exclusions for the following three measures are similar to the exclusions for the "Number of Days Hospitalized" analysis except records with missing Atlas Outcomes scores, outliers, and records with missing or invalid LOS are not excluded (see tables 8b and 8c).

Percent Receiving Cardiac Catheterization. The diagnostic cardiac catheterization procedure (ICD-9-CM codes 37.22 or 37.23) must have been performed (in any MDC 5 hospitalization, regardless of principal diagnosis) within 30 days of (or 3 days prior to) the index hospitalization admit date for a heart attack. Calculation of the catheterization percent incorporated the number of heart attack patients receiving catheterization procedures by plan in the numerator and the number of heart attack patients for each plan in the denominator. Note, when a procedure code for a diagnostic catheterization was not present in a heart attack record, it was assumed that the procedure was performed in conjunction with or prior to PTCA/Stent procedures and CABG surgeries, since all cases require a diagnostic catheterization in order to undergo therapeutic intervention/coronary revascularization.

Percent Receiving PTCA/Stent. The codes associated with PTCA/Stent include ICD-9-CM codes 36.01, 36.02, 36.05, 36.06, and 36.07. To be included in the analyses, these procedures must have been performed in any MDC 5 hospitalization within 30 days of the index hospitalization admit date for a heart attack. Calculation of this percent incorporated the number of heart attack patients receiving PTCA/Stent procedures for individual HMO plans in the numerator and the number of heart attack patients per plan in the denominator.

Percent Receiving Coronary Artery Bypass Graft (CABG). The ICD-9-CM codes associated with bypass surgery include 36.10-36.17, and 36.19. One or more of these procedure codes must have been present in any MDC 5 hospitalization within 30 days of the index hospitalization admit date for a heart attack. Calculation of the bypass surgery percent incorporated the number of heart attack patients receiving CABG procedures by plan in the numerator and the number of heart attack patients by plan in the denominator.

SURGICAL PROCEDURES

Hysterectomy

Inclusion Criteria

In the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, data are reported for abdominal and vaginal hysterectomies combined and separately. The study population included hospitalizations that were assigned a principal or secondary procedure code of hysterectomy (see Appendix A: "Description of Study Population"). Only adult (18 through 64 years of age) female

HMO members were included in this analysis. Hysterectomies performed due to cancer (ICD-9-CM diagnosis codes 179, 180.0-180.9, 181, 182.0-182.8, 183.0-183.9, 184.0-184.9, 198.6, 198.82, 233.1-233.3, 236.0-236.3, and 239.5 in any position), trauma of the female reproductive system (ICD-9-CM diagnosis codes 867.4-867.9, 868.00, 868.03, 868.04, 868.09, 868.10, 868.13, 868.14, 868.19, 869.0, 869.1, 879.6-879.9, 906.0, 908.2, 939.1, and 947.4 in any position), or other emergent occurrences such as pregnancy related complications were excluded. Thus, only non-traumatic and non-female reproductive malignant hysterectomies were analyzed. A total of 6,229 admissions (4,337 abdominal and 1,892 vaginal hysterectomies), after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Procedure Rate (age-adjusted). The procedure rate shown for each HMO used the total number of adult female index hospitalizations per 10,000 adult female members. Of the 7,071 hospitalizations for hysterectomy submitted to PHC4 for inclusion in the report, 842 records were excluded; of the 5,080 hospitalizations for abdominal hysterectomy, and 1,991 hospitalizations for vaginal hysterectomy, 743 and 99 records were excluded, respectively. These hospitalizations are listed in Table 9A. The HMO database was used as the comparative reference.

Table 9A. *Exclusions from "Procedure Rate" Analyses for Hysterectomy*

	Total HMO Hospitalizations					
	Total		*Abdominal*		*Vaginal*	
	N	*% of Total*	*N*	*% of Total*	*N*	*% of Total*
Total hospitalizations before exclusions	*7,071*	*100.0*	*5,080*	*100.0*	*1,991*	*100.0*
Exclusions:						
❖ Multiple Hysterectomies for One Patient	0	0.0	0	0.0	0	0.0
❖ Cancer[1, 2]	756	10.7	671	13.2	85	4.3
❖ Hemorrhage on Admission[2]	0	0.0	0	0.0	0	0.0
❖ Cases in DRGs Unrelated to Hysterectomy[2]	85	1.1	71	1.4	14	0.7
❖ HIV Infection[2]	0	0.0	0	0.0	0	0.0
❖ Abdominal Trauma	1	<0.1	1	<0.1	0	0.0
Total exclusions	*842*	*11.9*	*743*	*14.6*	*99*	*5.0*
Total members remaining in analysis	*6,229*	*88.1*	*4,337*	*85.4*	*1,892*	*95.0*

[1]These hospitalizations were excluded due to cancer status of any body site, including reproductive organs.
[2]See Appendix B for definitions of clinically complex exclusions and DRGs used to define hysterectomy.

In-Hospital Complications (risk-adjusted). This measure is reported separately for abdominal and vaginal adult hysterectomies and was calculated for each HMO. In-hospital complications are any one of a particular set of ICD-9-CM codes in any procedure or secondary diagnosis position in the index hysterectomy hospitalization (refer to Appendix C for a detailed description of the in-hospital complications). The exclusions to the in-hospital complications analysis for hysterectomy are outlined in Table 9B. The statewide database was used as the comparative reference.

Table 9B. *Exclusions from "In-Hospital Complications" Analyses for Hysterectomy*

	Total Statewide Hospitalizations			
	Abdominal		*Vaginal*	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations before exclusions	*15,958*	*100.0*	*6,188*	*100.0*
Exclusions:				
❖ Procedure Rate Exclusions	2,662	16.7	365	5.9
❖ Missing *Atlas Outcomes*™ Score	84	0.5	28	0.5
Total exclusions	*2,746*	*17.2*	*393*	*6.4*
Total members remaining in analysis	*13,212*	*82.8*	*5,795*	*93.6*

Length of Stay (risk-adjusted). The inpatient length of stay for hysterectomy is the period of hospitalization beginning with the date of admission of the hospitalization in which the hysterectomy procedure was performed and ending with the date of discharge of the same hospitalization (length of stay was calculated as discharge date minus admit date). The

exclusions to the risk-adjusted length of stay analysis for abdominal and vaginal hysterectomy are outlined in Table 9C. The statewide database was used as the comparative reference.

Table 9C. *Exclusions from "Length of Stay" (LOS) Analyses for Hysterectomy*

	Total Statewide Hospitalizations					
	Abdominal			*Vaginal*		
	N	***% of Total***	***Avg. LOS***	***N***	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	*15,958*	*100.0*	*3.0*	*6,188*	*100.0*	*1.7*
Exclusions						
❖ In-Hospital Complications Exclusions	2,746	17.2	4.6	393	6.4	1.9
❖ Death in Hospital	2	<.0001	3.5	0	0.0	0.0
❖ Outlier[1]/ Missing or Invalid[2] LOS	15	0.1	24.3	2	<.0001	13.5
Total exclusions	2,763	17.3	4.7	395	6.4	2.0
Total members remaining in analysis	*13,195*	*82.7*	*2.7*	*5,793*	*93.6*	*1.7*

[1]LOS > 16 days for abdominal and > 11 days for vaginal hysterectomy hospitalizations.
[2]LOS value < 0.

Breast Cancer Procedures

Inclusion Criteria

Only adult (age 18 through 64 years of age) female HMO members were included in this analysis. Cases were included in the data analysis for breast cancer procedures if they included a principal diagnosis of breast cancer and a procedure code, in any position, for lumpectomy and/or mastectomy (see Appendix A: "Description of Study Population" for a list of the ICD-9-CM and CPT codes included in the study). Results of analyses are reported for lumpectomy and mastectomy combined and separately. A total of 2,510 admissions (1,846 lumpectomy cases and 664 mastectomy cases), after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Procedure Rate (age-adjusted). The procedure rate is shown for each HMO using the total number of procedures (lumpectomies and mastectomies, both inpatient and ambulatory) per 10,000 adult female members. Procedure rates were based upon the *total number of breast cancer procedures,* not the number of patients receiving a breast cancer procedure. When two or more procedures (e.g., lumpectomy and mastectomy) were performed at the same time only the most invasive procedure (mastectomy) was included in the analysis. Thus, within an encounter, multiple procedures were tallied only once for the purpose of calculating the procedure rate; however, if a single patient had more than one encounter over the course of the study period, all encounters were included. Of the 2,510 breast cancer procedures (1,846 lumpectomy cases and 664 mastectomy cases) submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, none were excluded (see Table 9D). The HMO database served as the comparative reference.

Table 9D. *Exclusions from "Procedure Rate" Analyses for Breast Cancer Procedures– Inpatient and Ambulatory*

	Total HMO Procedures					
	Total		***Lumpectomy***		***Mastectomy***	
	N	***% of Total***	***N***	***% of Total***	***N***	***% of Total***
Total procedures before exclusions	*2,510*	*100.0*	*1,846*	*100.0*	*664*	*100.0*
Exclusions:						
❖ HIV Infection*	0	0.0	0	0.0	0	0.0
Total exclusions	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*
Total procedures remaining in analysis	*2,510*	*100.0*	*1,846*	*100.0*	*664*	*100.0*

*See Appendix B for definitions of clinically complex exclusions.

Percent Performed Inpatient. The percent of procedures that were performed in an inpatient setting is reported for both lumpectomies and mastectomies. All procedures that were counted in the respective procedure rates were included in this analysis. The percent is unadjusted.

In-Hospital Complications (risk-adjusted). This measure was calculated only for inpatient procedures for each HMO and is reported for mastectomy procedures. In-hospital complications are not reported for lumpectomy due to a low number of inpatient lumpectomies that results in an unreliable risk-adjustment model. In-hospital complications are any one of a particular set of ICD-9-CM codes in any procedure or secondary diagnosis position in a discharge record associated with the breast cancer procedure (refer to Appendix C for a detailed description of the in-hospital complications). The exclusions to the in-hospital complications analysis are found in Table 9E. The statewide database was used as the comparative reference.

Table 9E. *Exclusions from "In-Hospital Complications" Analyses for Breast Cancer Procedures–Inpatient Only*

	Total Statewide Procedures	
	Mastectomy	
	N	***% of Total***
Total procedures[1] before exclusions	*2,331*	*100.0*
Exclusions:		
❖ Procedure Rate Exclusions	0	0.0
❖ Ambulatory Case[2]	321	13.8
❖ Missing *Atlas Outcomes™* Score	30	1.3
Total exclusions	*351*	*15.1*
Total hospitalizations remaining in analysis	*1,980*	*84.9*

[1]Includes inpatient and ambulatory cases.
[2]Records related to ambulatory care were not analyzed in the in-hospital complications percent since this was derived from inpatient records only.

Length of Stay (risk-adjusted) analyses are reported separately for lumpectomy and mastectomy procedures. Only inpatient hospitalizations were included in the length of stay outcome measure. Length of stay was calculated from a single hospitalization only, beginning with the date of admission and ending with the date of discharge (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the analysis are listed in Table 9F. The statewide database was used as the comparative reference.

Table 9F. *Exclusions from "Length of Stay" (LOS) Analyses for Breast Cancer Procedures–Inpatient Only*

	Total Statewide Procedures					
	Lumpectomy			*Mastectomy*		
	N	***% of Total***	***Avg. LOS[1]***	***N***	***% of Total***	***Avg. LOS[1]***
Total procedures[2] before exclusions	*6,283*	*100.0*	*1.4*	*2,331*	*100.0*	*2.3*
Exclusions:						
❖ Procedure Rate Exclusions	0	0.0	NA	0	0.0	NA
❖ Ambulatory Case[3]	5,784	92.1	NA	321	13.8	NA
❖ Missing *Atlas Outcomes™* Score	7	0.1	4.0	30	1.3	2.4
❖ Death in Hospital	0	0.0	NA	0	0.0	NA
❖ Outlier[4]/Missing or Invalid[5] LOS	4	0.1	13.0	1	<0.1	59.0
Total exclusions	*5,795*	*92.2*	*7.3*	*352*	*15.1*	*4.2*
Total hospitalizations remaining in analysis	*488*	*7.8*	*1.3*	*1,979*	*84.9*	*2.3*

[1] Based on inpatient cases only.
[2]Includes inpatient and ambulatory cases.
[3]Lumpectomy and mastectomy statewide records related to ambulatory care were not analyzed in the in-hospital complications percent since this was derived from inpatient cases only.
[4]LOS > 8 days for lumpectomy and > 15 days for mastectomy procedures.
[5]LOS value < 0.
NA: Not Applicable

Neck and Back Procedures

Inclusion Criteria

Adult (18 through 64 years of age) HMO members were included in the analyses of neck and back procedures. Cases were included in the data analysis if they included a principal diagnosis and a procedure code (in any position) of one of the ICD-9-CM codes listed in Appendix A: "Description of Study Population." A total of 5,118 admissions (1,822 with fusion and 3,296 without fusion), after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Procedure Rate (age and sex-adjusted). The procedure rate is shown for each HMO using the total number of neck and back procedures (fusion and non-fusion combined) per 10,000 adult HMO members. Of the 5,150 (1,848 with fusion and 3,302 without fusion) neck and back procedures submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 32 (26 with fusion and 6 without fusion) records were excluded. These hospitalizations are listed in Table 9G. The HMO database was used as the comparative reference.

Table 9G. *Exclusions from "Procedure Rate" Analyses for Neck and Back Procedures – Inpatient and Ambulatory*

	Total HMO Hospitalizations					
	Total		*With Fusion*		*Without Fusion*	
	N	*% of Total*	*N*	*% of Total*	*N*	*% of Total*
Total procedures before exclusions	*5,150*	*100.0*	*1,848*	*100.0*	*3,302*	*100.0*
Exclusions:						
❖ Refusion*	18	0.3	17	0.9	1	<0.1
❖ Pathological Spinal Fracture*	3	0.1	3	0.2	0	0.0
❖ Spinal Nerve Root Injury*	4	0.1	1	0.1	3	0.1
❖ Paraplegia*	0	0.0	0	0.0	0	0.0
❖ Quadriplegia*	2	<0.1	2	0.1	0	0.0
❖ Hemiplegia*	0	0.0	0	0.0	0	0.0
❖ Unspecified Paralysis*	1	<0.1	0	0.0	1	<0.1
❖ Spinal Fracture*	3	0.1	2	0.1	1	<0.1
❖ HIV Infection; Infantile Cerebral Palsy*	1	<0.1	1	< 0.1	0	0.0
Total exclusions	*32*	*0.6*	*26*	*1.4*	*6*	*0.2*
Total procedures remaining in analysis	*5,118*	*99.4*	*1,822*	*98.6*	*3,296*	*99.8*

*See Appendix B for definitions of clinically complex exclusions.

Percent Performed Inpatient. The percent of procedures that were performed in an inpatient setting is reported for both fusion and non-fusion procedures. All procedures that were counted in the respective procedure rates were included in this analysis. The percent is unadjusted.

In-Hospital Complications (risk-adjusted). This measure was calculated only for inpatient procedures for each HMO and is reported separately for fusion and non-fusion procedures. In-hospital complications are any one of a particular set of ICD-9-CM codes in any procedure or secondary diagnosis position in a discharge record associated with the neck/back hospitalization (refer to Appendix C for a detailed description of the in-hospital complications). The exclusions to the in-hospital complications analysis are found in Table 9H. The statewide database was used as the comparative reference.

Table 9H. *Exclusions from "In-Hospital Complications" Analyses for Neck and Back Procedures – Inpatient Only*

	Total Statewide Hospitalizations			
	With Fusion		*Without Fusion*	
	N	*% of Total*	*N*	*% of Total*
Total procedures[1] before exclusions	*6,994*	*100.0*	*12,563*	*100.0*
Exclusions:				
❖ Procedure Rate Exclusions	173	2.5	48	0.4
❖ Missing *Atlas Outcomes™* Score	29	0.4	68	0.5
❖ Improper Coding of Fusion Technique[2]	19	0.3	NA	NA
❖ Ambulatory Cases[3]	515	7.4	3,109	24.7
Total exclusions	*736*	*10.5*	*3,225*	*25.7*
Total hospitalizations remaining in analysis	*6,258*	*89.5*	*9,338*	*74.3*

[1]Includes inpatient and ambulatory cases
[2]Fusion technique was tested as a risk factor for in-hospital complications. Therefore, if the ICD-9-CM procedure coding did not clearly indicate the fusion technique, the hospitalization(s) was excluded from the complications analysis.
[3]Records related to ambulatory care were not analyzed in the in-hospital complications percent since this was derived from inpatient records only.
NA: Not Applicable

Length of Stay (risk-adjusted). Length of stay was calculated from a single hospitalization only, beginning with the date of admission and ending with the date of discharge (length of stay was calculated as discharge date minus admit date). It is reported separately for fusion and non-fusion procedures and was calculated for each HMO. Only inpatient hospitalizations were included in the length of stay measure. Hospitalizations that were excluded from the risk-adjusted length of stay analysis for neck and back procedures are listed in Table 9I. The statewide database was used as the comparative reference.

Table 9I. *Exclusions from "Length of Stay" (LOS) Analysis for Inpatient Neck and Back Procedures*

	Total Statewide Inpatient Procedures					
	With Fusion			*Without Fusion*		
	N	*% of Total*	*Avg. LOS[1]*	*N*	*% of Total*	*Avg. LOS*
Total procedures[2] before exclusions	*6,994*	*100.0*	*2.4*	*12,563*	*100.0*	*1.7*
Exclusions:						
❖ In-Hospital Complications Exclusions	736	10.5	3.8	3,225	25.7	2.9
❖ Death in Hospital	3	< 0.1	8.3	3	< 0.1	4.0
❖ Outlier[3]/Missing or Invalid[4] LOS	11	0.2	30.1	7	0.1	25.4
Total exclusions	*750*	*10.7*	*5.1*	3,235	*25.8*	*4.2*
Total hospitalizations remaining in analysis	*6,244*	*89.3*	*2.3*	*9,328*	*74.2*	*1.7*

[1]Based on inpatient cases only.
[2]Includes inpatient and ambulatory cases.
[3]LOS > 20 days for neck and back procedures with fusion and > 16 days for procedures without fusion.
[4]LOS value < 0.

Prostatectomy

Inclusion Criteria

Only adult (18 through 64 years of age) male HMO members were included in this analysis. Cases were included in the data analysis for prostatectomy if they included one of the procedure ICD-9-CM codes (in any position) for radical prostatectomy listed in Appendix A: "Description of Study Population." Prostatectomies done by a different surgical approach (i.e., transurethral prostatectomy) were not included. Radical prostatectomy is most often done when cancer is present or assumed to be present. The clinical indications for choosing one surgical approach over another for prostatectomy are very different. If a record included codes for both radical and

transurethral prostatectomies it was included in the analysis as a radical prostatectomy. A total of 587 admissions, after exclusions, matched these criteria.

Utilization/Outcome Measures and Exclusion Criteria

Procedure Rate (age-adjusted). The procedure rate is shown for each HMO using the total number of procedures per 10,000 male HMO members. Of the 590 prostatectomy procedures submitted to PHC4 for inclusion in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report, 3 records were excluded. These exclusions are listed in Table 9J. The HMO database was used as the comparative reference.

Table 9J. *Exclusions from "Procedure Rate" Analysis for Prostatectomy*

	Total HMO Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*590*	*100.0*
Exclusions:		
❖ Multiple Prostatectomy Procedures for One Patient	0	0.0
❖ HIV Infection*	1	0.2
❖ Cases in DRGs Unrelated to Prostatectomy*	2	0.3
Total exclusions	*3*	*0.5*
Total hospitalizations remaining in analysis	*587*	*99.5*

*See Appendix B for definitions of clinically complex exclusions and DRGs used to define prostatectomy.

In-Hospital Complications (risk-adjusted). This measure was calculated for each HMO. In-hospital complications are any one of a particular set of ICD-9-CM codes in any procedure or secondary diagnosis position in the index prostatectomy hospitalization (refer to Appendix C for a detailed description of the complications). The exclusions to the in-hospital complications analysis are found in Table 9K. The statewide database was used as the comparative reference.

Table 9K. *Exclusions from "In-Hospital Complications" Analysis for Prostatectomy*

	Total Statewide Hospitalizations	
	N	***% of Total***
Total hospitalizations before exclusions	*1,844*	*100.0*
Exclusions:		
❖ Procedure Rate Exclusions	18	1.0
❖ Missing *Atlas Outcomes*^{TM} Score	11	0.6
Total exclusions	*29*	*1.6*
Total hospitalizations remaining in analysis	*1,815*	*98.4*

Length of Stay (risk-adjusted). Length of stay was calculated from a single hospitalization only, beginning with the date of admission and ending with the date of discharge (length of stay was calculated as discharge date minus admit date). Hospitalizations that were excluded from the risk-adjusted length of stay analysis for prostatectomy procedures are listed in Table 9L. The statewide database was used as the comparative reference.

Table 9L. *Exclusions from "Length of Stay" (LOS) Analysis for Prostatectomy*

	Total Statewide Hospitalizations		
	N	***% of Total***	***Avg. LOS***
Total hospitalizations before exclusions	*1,844*	*100.0*	*3.1*
Exclusions:			
❖ In-Hospital Complications Exclusion	29	1.6	7.5
❖ Death in Hospital	0	0.0	NA
❖ Outlier[1]/Missing or Invalid[2] LOS	4	0.2	21.0
Total exclusions	*33*	*1.8*	*9.1*
Total hospitalizations remaining in analysis	*1,811*	*98.2*	*3.0*

[1]LOS > 15 days for prostatectomy.
[2]LOS value < 0.

MEMBER SATISFACTION

Satisfaction Measures

The following CAHPS Survey Questions are included in the *Measuring the Quality of Pennsylvania's Commercial HMOs* report for calendar year 2004:

- Question 9 "In the last 12 months, how much of a problem, if any, was it to see a specialist that you needed to see?"
- Question 17 "In the last 12 months, when you needed care right away for an illness, injury or condition, how long did you usually have to wait between trying to get care and actually seeing a provider?"
- Question 18 "In the last 12 months, not counting the times you needed health care right away, did you make any appointments with a doctor or other health provider for health care?"
- Question 20 "In the last 12 months, not counting the times you needed health care right away, how many days did you usually have to wait between making an appointment and actually seeing a provider?"
- Question 24 "In the last 12 months, how much of a problem, if any, was it to get the care, tests or treatment you or a doctor believed necessary?"
- Question 26 "In the last 12 months, how much of a problem, if any, were delays in health care while you waited for approval from your health plan?"
- Question 42 "In the last 12 months, how much of a problem, if any, was it to get the help you needed when you called your health plan's customer service?"
- Question 43 "In the last 12 months, have you called or written your health plan with a complaint or problem?"
- Question 45 "Was your complaint or problem settled to your satisfaction?"
- Question 49 "How would you rate your health plan?"

All reported CAHPS measures include an average for the group of Pennsylvania HMO plans. These averages were calculated by PHC4 by weighting each plan's score by its CY2004 total commercial enrollment. National averages were also included when available from NCQA. The national averages (provided in the NCQA *Quality Compass*® database) include all lines of business across all reporting managed care organizations in the United States.

FINANCIAL INDICATORS

Financial information on the HMO plans is reported on the PHC4 Web site only. Each HMO submitted all data used in the financial section of the report as part of their 2001 – 2004 *Annual Statements* filed with the National Association of Insurance Commissioners (NAIC). The data elements that pertain to commercial members (e.g., Commercial Premium Revenue) do not include government-funded HMO members, such as Medicare or Medical Assistance, but do include federal employee benefit programs. The following table outlines the locations of the data elements in the *Annual Statements.*

Table 10. *Location of Data Elements in the Annual Statement*

Financial Measures	Location in Annual Statement*
2004 Total Premium Revenue	Page 4, Line 2, Column 2
2001 Total Premium Revenue	Page 4, Line 2, Column 3 (CY2002)
2004 Commercial Premium Revenue	Page 7, Line 1, Columns 2, 6, 12 & 13 (if applicable)
2004 Commercial Medical Expenses	Page 7, Line 17, Columns 2, 6, 12 & 13 (if applicable)
2004 Commercial Underwriting Gain/Loss	Page 7, Line 24, Columns 2, 6, 12, & 13 (if applicable)
2004 Total Revenue	Page 4, Lines 8, 27, & 29, Column 2
2004 Net Income	Page 4, Line 32, Column 2
2003 Total Revenue	Page 4, Line 8, 27 & 29, Column 3
2002 Total Revenue	Page 4, Line 8, 27 & 29, Column 3 (CY2003)
2003 Net Income	Page 4, Line 32, Column 3
2002 Net Income	Page 4, Line 32, Column 3 (CY2003)
2004 Cash and Short-term Investments	Page 2, Line 5, Column 3
2004 Claims Payable	Page 3, Line 1, Column 3

*Refers to each plan's CY2004 *Annual Statement* unless noted otherwise.

Definitions and formulas for the specific financial indicators are listed below:

Total Premium Revenue reflects total premium revenue from the plan, including Medicare and Medical Assistance.

3-year Change in Total Premium Revenue shows the change in total premium revenues from the end of CY2001 to the end of CY2004. This measure reflects the extent to which the plan is growing or declining.

$$\frac{\textit{Total Premium Revenue}_{2004} - \textit{Total Premium Revenue}_{2001}}{\textit{Total Premium Revenue}_{2001}}$$

Commercial Premium Revenue as a Percent of Total Premium Revenue reflects the commercial portion of the plan's total line of business. For those plans where commercial revenue is less than 100% of total premium revenue, the balance of the premium revenue is derived from Medicare and Medical Assistance business and administrative service contracts.

$$\frac{\textit{Commercial Premium Revenue}_{2004}}{\textit{Total Premium Revenue}_{2004}}$$

Commercial Medical Loss Ratio reflects the portion of each commercial premium dollar spent on health care during CY2004. If a plan has a Medical Loss Ratio above 100%, it is spending more for healthcare services than it receives in commercial premiums.

$$\frac{\textit{Commercial Medical Expenses}_{2004}}{\textit{Commercial Premium Revenue}_{2004}}$$

Commercial Net (pre-tax) Underwriting Margin shows the portion of commercial premium revenue that remained as income or profit after all expenses (except income taxes) related to commercial members had been paid. A negative margin indicates that revenues were not sufficient to cover expenses and the plan's commercial line of business operated at a loss for the calendar year.

$$\frac{\textit{Commercial Underwriting Gain/Loss}_{2004}}{\textit{Commercial Premium Revenue}_{2004}}$$

Total Net (after-tax) Margin shows the portion of Total Revenue that remained as income or profit after all expenses (including taxes) had been paid. A negative margin indicates that revenues were not sufficient to cover expenses and the plan operated at a loss.

$$\frac{\textit{Total Net Income}_{2004}}{\textit{Total Revenue}_{2004}}$$

3-year Average Total Net Margin reflects the average after tax net income over the past three calendar years (CY2002 – CY2004) for the total plan.

$$\frac{\Sigma_{2002,2003,2004}\,\textit{Total Net Income}}{\Sigma_{2002,2003,2004}\,\textit{Total Revenue}}$$

Cash to Claims Payable is the ratio between cash and short-term investments to claims payable. Claims payable includes both known and estimated unreported claims. This measure reflects the ability of the insurer to pay outstanding claims out of its liquid assets in the event that premium revenue was to fall short of health care reimbursements.

$$\frac{\textit{Cash \& Short-term Investments}_{2004}}{\textit{Claims Payable}_{2004}}$$

HMO PLAN PROFILE

The HMO "Plan Profile" is found on the PHC4 Web site only. The specific source of data and the determination of the information in the HMO profile is as follows:

Number of Commercial Members. The number of commercial members, as of December 31, 2004, is found in section III.A. columns 1 through 4 of the *Annual Report* submitted to the Pennsylvania Department of Health. Enrollment numbers reported on the PHC4 Web site, identified as the "Number of Commercial Members," reflect the sum of these columns. Only HMO members enrolled in the Pennsylvania operations of HMOs were included in this total. Some HMOs operate health care plans regionally or nationally; however, only those members that belong to an HMO licensed to operate in Pennsylvania were counted.

Change in Commercial Enrollment. The procedure outlined above was also followed for the December 31, 2004 *Annual Report*. The 2003 totals were then subtracted from the 2004 totals and the percent change is reported and is identified as the "Change in Commercial Enrollment" variable on the PHC4 Web site.

NCQA Accreditation Status. The "NCQA Accreditation Status" variable was obtained from the NCQA Web site and was current as of the publication date of the *CY2004 Measuring the Quality of Pennsylvania's Commercial HMOs*.

APPENDICES

Preventing Hospitalization Through Primary Care

Ear, Nose and Throat Infections *(Pediatric and Adult)*	*Any one of the following ICD-9-CM diagnosis codes in the principal position:* 017.4x (x = 0-6), 034.0, 055.2, 112.82, 380.10, 380.11, 380.12, 380.14, 380.16, 381.00, 381.01, 381.02, 381.03, 381.04, 381.05, 381.06, 381.10, 381.19, 381.20, 381.29, 381.3, 381.4, 382.00, 382.01, 382.1, 382.2, 382.3, 382.4, 382.9, 461.0, 461.1, 461.2, 461.3, 461.8, 461.9, 462, 463, 464.00, 464.01, 464.20, 464.21, 464.30, 464.31, 464.4, 464.50, 464.51, 465.0, 465.8, 465.9, 472.0, 472.1, 472.2, 473.0, 473.1, 473.2, 473.3, 473.8, 473.9, 474.00, 474.01, 474.02, 476.0, 476.1, 487.1
High Blood Pressure	*Any one of the following ICD-9-CM diagnosis codes in the principal position:* 401.0, 401.1, 401.9, 402.00, 402.10, 402.90, 403.00, 403.10, 403.90, 404.00, 404.10, 404.90
Gastrointestinal Infections	*Any one of the following ICD-9-CM diagnosis codes in the principal position:* 003.0, 006.2, 009.0, 009.1, 558.2, 558.9
Kidney/Urinary Tract Infections	*Any one of the following ICD-9-CM diagnosis codes in the principal position:* 590.00, 590.01, 590.10, 590.11, 590.2, 590.3, 590.80, 590.9, 595.x (x=0-3), 595.81, 595.89, 595.9, 599.0

Managing On-Going Illness

Chronic Obstructive Pulmonary Disease	*Any one of the following ICD-9-CM diagnosis codes in the principal position:* 491.20, 491.21, 492.0, 492.8, 496, 506.4
Asthma *(Pediatric and Adult)*	*Any one of the following ICD-9-CM diagnosis codes in the principal position:* 493.00, 493.01, 493.02, 493.10, 493.11, 493.12, 493.20, 493.21, 493.22, 493.81, 493.82, 493.90, 493.91, 493.92
Diabetes	*Any one of the following ICD-9-CM diagnosis codes in the principal position:* 250.xy (x = 0-9, y = 0-3)

Heart Attack

Heart Attack	*Any one of the following ICD-9-CM diagnosis codes in the principal position:* 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91

Surgical Procedures

Hysterectomy *(Abdominal)* *(Vaginal)*	*Any one of the following ICD-9-CM procedure codes in the any position:* 68.31, 68.39, 68.4, 68.6, 68.7 68.51, 68.59, 68.9
Breast Cancer Procedures *(Lumpectomy)*	*Any one of the following ICD-9-CM or CPT procedure codes in any position:* 85.20, 85.21, 85.22, 85.23, 19112, 19120, 19125, 19126, 19160, 19162, *AND* *Any one of the following ICD-9-CM diagnosis codes in the principal position:* 174.0, 174.1, 174.2, 174.3, 174.4, 174.5, 174.6, 174.8, 174.9, 196.3, 198.2, 198.81, 233.0, 238.3, 239.3
(Mastectomy)	*Any one of the following ICD-9-CM or CPT procedure codes in any position:* 85.41, 85.42, 85.43, 85.44, 85.45, 85.46, 85.47, 85.48, 19180, 19200, 19220, 19240 *AND* *Any one of the following ICD-9-CM diagnosis codes in the principal position:* 174.0, 174.1, 174.2, 174.3, 174.4, 174.5, 174.6, 174.8, 174.9, 196.3, 198.2, 198.81, 233.0, 238.3, 239.3
(Reconstruction)	*Any one of the following ICD-9-CM procedure codes in any position:* 85.50, 85.51, 85.52, 85.53, 85.54, 85.7, 85.82, 85.83, 85.84, 85.85, 85.86, 85.87, 85.93, 85.96

Neck and Back Procedures *(With Fusion)*	*Any one of the following ICD-9-CM or CPT procedure codes in any position:* 03.09, 80.50, 80.51, 80.59, 63001, 63003, 63005, 63011, 63012, 63015, 63016, 63017, 63045, 63046, 63047, 63055, 63056, 63064, 22220, 22222, 22224, 63020, 63030, 63040, 63042, 63075, 63077 *AND* *Any one of the following ICD-9-CM or CPT fusion codes in any position:* 81.00, 81.01, 81.02, 81.03, 81.04, 81.05, 81.06, 81.07, 81.08, 81.61, 81.62, 81.63, 81.64, 22800, 22802, 22804, 22808, 22810, 22812, 22548, 22590, 22595, 22554, 22600, 22556, 22610, 22558, 22612, 22630 *AND* *Any one of the following ICD-9-CM diagnosis codes in the principal position:* 720.0, 721.0, 721.1, 721.2, 721.3, 721.41, 721.42, 721.90, 721.91, 722.0, 722.10, 722.11, 722.2, 722.4, 722.51, 722.52, 722.6, 722.70, 722.71, 722.72, 722.73, 722.90, 722.91, 722.92, 722.93, 723.0, 723.1, 724.00, 724.01, 724.02, 724.09, 724.1, 724.2, 724.3, 724.5, 738.4, 756.11, 756.12
(Without Fusion)	*Any one of the following ICD-9-CM or CPT procedure codes in any position:* 03.09, 80.50, 80.51, 80.59, 63001, 63003, 63005, 63011, 63012, 63015, 63016, 63017, 63045, 63046, 63047, 63055, 63056, 63064, 22220, 22222, 22224, 63020, 63030, 63040, 63042, 63075, 63077 *AND* *Any one of the following ICD-9-CM diagnosis codes in the principal position:* 720.0, 721.0, 721.1, 721.2, 721.3, 721.41, 721.42, 721.90, 721.91, 722.0, 722.10, 722.11, 722.2, 722.4, 722.51, 722.52, 722.6, 722.70, 722.71, 722.72, 722.73, 722.90, 722.91, 722.92, 722.93, 723.0, 723.1, 724.00, 724.01, 724.02, 724.09, 724.1, 724.2, 724.3, 724.5, 738.4, 756.11, 756.12
Prostatectomy	*Any one of the following ICD-9-CM procedure codes in any position:* 60.3, 60.4, 60.5, 60.62, 60.69

Clinically Complex Exclusions

Exclusion	Definition[1]
Cancer	Dx: 140.0-208.9, 230.0-239.9
Chronic Renal Failure	Dx: 585
Cleft Lip and Palate Repair	DRG: 052
Ear, Nose, or Throat Cancer	Dx: 146.0-146.9, 147.0-147.3, 147.8, 147.9, 148.0-148.3, 148.8, 148.9, 149.0, 149.1, 149.8, 149.9, 160.0-160.5, 160.8, 160.9, 161.0-161.3, 161.8, 161.9, 162.0, 231.0, 231.1, 231.8, 231.9, 235.1, 235.6, 235.9
Extensive OR Procedures Unrelated to Principal Diagnosis	DRG: 468
Gastrointestinal Cancer	Dx: 150.0-150.5, 150.8, 150.9, 151.0-151.6, 151.8, 151.9, 152.0-152.3, 152.8, 152.9, 153.0-153.9, 154.0-154.3, 154.8, 155.0-155.2, 156.0-156.2, 156.8, 156.9, 157.0-157.4, 157.8, 157.9, 158.0, 158.8, 158.9, 159.0, 159.8, 159.9, 195.2, 197.4-197.8, 230.1-230.9, 235.2-235.5, 239.0
Heart or Heart and Lung Transplant	Px: 33.6, 37.51, 37.52
Hemiplegia	Dx: 342.00-342.02, 342.10-342.12, 342.80-342.82, 342.90-342.92
Hemorrhage	Dx: 998.11
HIV Infection	Dx: 042
Infantile Cerebral Palsy	Dx: 343.0-343.3
Kidney, Ureter and Major Bladder Procedures for Nonneoplasms with CC‡	DRG: 304
Kidney, Ureter and Major Bladder Procedures for Nonneoplasms without CC‡	DRG: 305
Kidney/Urinary Tract Cancer	Dx: 188.0-188.9, 189.0-189.4, 189.8, 189.9, 233.7, 233.9, 236.7, 236.90, 236.91, 236.99, 239.4
Lung Cancer	Dx: 162.2-162.5, 162.8, 162.9, 197.0, 231.2, 235.7, 239.1
Major Large and Small Bowel Procedures with CC‡	DRG: 148
Major Large and Small Bowel Procedures without CC‡	DRG: 149
Major Organ Transplant	Px: 33.50-33.52, 33.6, 37.51, 37.52, 41.00-41.09, 41.94, 46.97, 50.51, 50.59, 52.80-52.86, 55.61, 55.69
Mechanical Ventilation	Px: 96.70, 96.71, 96.72
Metastatic Cancer	Dx: 196.0-196.3, 196.5, 196.6, 196.8, 196.9, 197.0-197.8, 198.0-198.7, 198.81, 198.82, 198.89, 199.0, 199.1
Open Heart Surgery	Dx: 35.00-35.04, 35.10-35.14, 35.20-35.28, 35.31-35.35, 35.39, 35.42, 35.50-35.54, 35.60-35.63, 35.70-35.73, 35.81-35.84, 35.91-35.95, 35.98, 35.99, 36.10-36.17, 36.19, 36.2, 36.31, 36.32, 36.39, 36.91, 36.99, 37.10-37.12, 37.31-37.33, 37.4, 37.51, 37.52, 37.53
Other Digestive System OR Procedures with CC‡	DRG: 170
Paraplegia	Dx: 344.1
Pathological Spinal Fracture	Dx: 733.13
PTCA/Stent	Px: 36.01, 36.02, 36.05, 36.06, 36.07
Quadriplegia	Dx: 344.00-344.04, 344.09
Refusion	Px: 81.30-81.39 in any position
Renal Dialysis	Dx: V45.1, V56.0, V56.8 Px: 39.95, 54.98
Spinal Fracture	Dx: 805.0x, 805.1x, x=0-8; 805.2-805.9; 806.0x, x=0-9; 806.1x, x=0-9; 806.2x, x=0-9; 806.3x, x=0-9; 806.4; 806.5; 806.6x, x=0-2, 9; 806.7x, x=0-2, 9; 806.8; 806.9
Spinal Nerve Root Injury	Dx: 952.0x, x=0-9; 952.1x, x=0-9; 952.2; 952.3; 952.4; 952.8; 952.9; 953.0-953.5; 953.8; 953.9; 954.0; 954.1; 954.8; 954.9
Tracheitis	Dx: 464.10, 464.11, 464.20, 464.21
Tracheostomy	Px: 31.1, 31.21, 31.29
Unspecified Paralysis	Dx: 344.9

[1]Cases are defined by ICD-9-CM Diagnosis (Dx)/ Procedure (Px) Codes or Diagnostic Related Group (DRG).
‡Comorbidity(s) and/or Complication(s)

DRGs Used to Define Conditions

Listed below are the DRGs used to define cases related to kidney/urinary tract infections, COPD, diabetes, hysterectomy, and prostatectomy. For each condition, cases in DRGs other than those below are considered clinically complex and are excluded.

Kidney/Urinary Tract Infection cases are restricted to the following DRGs:

320 Kidney and Urinary Tract Infections, Age Greater than 17 with CC‡
321 Kidney and Urinary Tract Infections, Age Greater than 17 without CC‡
322 Kidney and Urinary Tract Infections, Age 0 – 17

COPD cases are restricted to the following DRG:

88 Chronic Obstructive Pulmonary Disease

Diabetes cases are restricted to the following DRGs:

018 Cranial and Peripheral Nerve Disorders with CC‡
019 Cranial and Peripheral Nerve Disorders without CC‡
113 Amputation for Circulatory System Disorders Except Upper Limb and Toe
114 Upper Limb and Toe Amputation for Circulatory System Disorders
130 Peripheral Vascular Disorders with CC‡
131 Peripheral Vascular Disorders without CC‡
285 Amputation of Lower Limb for Endocrine, Nutritional and Metabolic Disorders
294 Diabetes, Age Greater than 35
295 Diabetes, Age 0 – 35
331 Other Kidney and Urinary Tract Diagnoses, Age Greater than 17 with CC‡
332 Other Kidney and Urinary Tract Diagnoses, Age Greater than 17 without CC‡

Hysterectomy (abdominal and vaginal) cases are restricted to the following DRGs:

353 Pelvic Evisceration, Radical Hysterectomy and Radical Vulvectomy
354 Uterine and Adnexa Procedures for Nonovarian/Adnexal Malignancy with CC‡
355 Uterine and Adnexa Procedures for Nonovarian/Adnexal Malignancy without CC‡
357 Uterine and Adnexa Procedures for Ovarian or Adnexal Malignancy
358 Uterine and Adnexa Procedures for Nonmalignancy with CC‡
359 Uterine and Adnexa Procedures for Nonmalignancy without CC‡

Prostatectomy cases are restricted to the following DRGs:

306 Prostatectomy with CC‡
307 Prostatectomy without CC‡
334 Major Male Pelvic Procedures with CC‡
335 Major Male Pelvic Procedures without CC‡

‡CC: Complication(s) and/or Comorbidity(s)

Statewide In-Hospital Complications for Hysterectomy

Total Abdominal Cases†				***Total Vaginal Cases†***			
Complication Type	**#**	**%**	**Avg. LOS**	**Complication Type**	**#**	**%**	**Avg. LOS**
• Procedure/Medical Care Related Events	449	3.4	4.0	• Procedure/Medical Care Related Events	145	2.5	2.4
• Postoperative Hemorrhage	260	2.0	4.2	• Postoperative Hemorrhage	110	1.9	2.6
• Digestive System Complications	225	1.7	5.8	• Postoperative Pulmonary Compromise	24	0.4	2.3
• Postoperative Pulmonary Compromise	179	1.4	4.9	• Digestive System Complications	19	0.3	2.9
• Postoperative Infection	91	0.7	6.6	• Hypo/Hypertension	16	0.3	2.6
• Postoperative Cardiac Complications	53	0.4	3.3	• Postoperative Cardiac Complications	9	0.2	1.8
• Postoperative Pneumonia	47	0.4	6.7	• Postoperative Infection	6	0.1	4.2
• Hypo/Hypertension	40	0.3	3.5	• Postoperative Pneumonia	6	0.1	4.2
• Postoperative Venous Thrombosis/Pulmonary Embolism	16	0.1	8.2	• Device, Implant or Graft Complications	2	<0.1	2.0
• Postoperative Stroke/Anoxic Brain Damage	4	<0.1	8.0	• Postoperative Venous Thrombosis/Pulmonary Embolism	1	<0.1	5.0
• Device, Implant or Graft Complications	4	<0.1	3.5	• Postoperative Stroke/Anoxic Brain Damage	1	<0.1	1.0
• Death	2	<0.1	3.5	• Gastric/Intestinal Hemorrhage or Ulceration	0	0.0	NA
• Gastric/Intestinal Hemorrhage or Ulceration	0	0.0	NA	• Death	0	0.0	NA
Any Complication Above	***1,188***	***9.0***	***4.3***	***Any Complication Above***	***313***	***5.4***	***2.5***
Without Any Complication Above	***2,024***	***91.0***	***2.6***	***Without Any Complication Above***	***5,48***	***94.6***	***1.6***

Statewide In-Hospital Complications for Breast Cancer Procedures

Total Mastectomy Cases†			
Complication Type	**#**	**%**	**Avg. LOS**
• Postoperative Hemorrhage	43	2.2	3.6
• Procedure/Medical Care Related Events	15	0.8	4.9
• Postoperative Pulmonary Compromise	15	0.8	8.4
• Device, Implant or Graft Complications	12	0.6	5.3
• Postoperative Infection	9	0.5	12.8
• Digestive System Complications	8	0.4	3.1
• Postoperative Venous Thrombosis/Pulmonary Embolism	4	0.2	18.3
• Hypo/Hypertension	4	0.2	3.3
• Postoperative Cardiac Complications	2	0.1	7.0
• Postoperative Pneumonia	0	0.0	NA
• Postoperative Stroke/Anoxic	0	0.0	NA
• Gastric/Intestinal Hemorrhage or Ulceration	0	0.0	NA
• Death	0	0.0	NA
• Lymphedema	0	0.0	NA
Any Complication Above	***100***	***5.1***	***4.7***
Without Any Complication Above	***1,880***	***94.9***	***2.2***

†The term "cases" refers to hospitalizations after exclusions.
NA: Not Applicable

Statewide In-Hospital Complications for Neck and Back Procedures

Total Cases† With Fusion				*Total Cases† Without Fusion*			
Complication Type	**#**	**%**	**Avg. LOS**	**Complication Type**	**#**	**%**	**Avg. LOS**
▪ Procedure/Medical Care Related Events	146	2.3	4.8	▪ Procedure/Medical Care Related Events	263	2.8	3.3
▪ Postoperative Pulmonary Compromise	58	0.9	7.7	▪ Postoperative Stroke/Anoxic Brain Damage	63	0.7	3.3
▪ Digestive System Complications	55	0.9	4.9	▪ Digestive System Complications	34	0.4	3.1
▪ Postoperative Hemorrhage	40	0.6	7.0	▪ Postoperative Pulmonary Compromise	29	0.3	3.0
▪ Device, Implant or Graft Complications	35	0.6	4.2	▪ Postoperative Hemorrhage	18	0.2	5.0
▪ Hypo/Hypertension	21	0.3	5.0	▪ Postoperative Cardiac Complications	18	0.2	3.8
▪ Postoperative Stroke/Anoxic Brain Damage	21	0.3	6.9	▪ Hypo/Hypertension	16	0.2	2.4
▪ Postoperative Pneumonia	18	0.3	8.8	▪ Device, Implant or Graft Complications	8	0.1	3.9
▪ Postoperative Cardiac Complications	11	0.2	6.2	▪ Postoperative Pneumonia	7	0.1	4.7
▪ Postoperative Venous Thrombosis/Pulmonary Embolism	10	0.2	13.1	▪ Postoperative Infection	6	0.1	7.2
▪ Postoperative Infection	9	0.1	17.8	▪ Postoperative Venous Thrombosis/Pulmonary Embolism	5	0.1	7.6
▪ Death	3	<0.1	8.3	▪ Death	3	<0.1	4.0
▪ Gastric/Intestinal Hemorrhage or Ulceration	1	<0.1	1.0	▪ Gastric/Intestinal Hemorrhage or Ulceration	1	<0.1	1.0
Any Complication Above	***362***	***5.8***	***5.5***	***Any Complication Above***	***444***	***4.8***	***3.4***
Without Any Complication Above	***5,896***	***94.2***	***2.1***	***Without Any Complication Above***	***8,894***	***95.2***	***1.6***

Statewide In-Hospital Complications for Prostatectomy

Total Cases†			
Complication Type	**#**	**%**	**Avg. LOS**
▪ Digestive System Complications	36	2.0	4.8
▪ Postoperative Hemorrhage	36	2.0	4.2
▪ Procedure/Medical Care Related Events	34	1.9	4.5
▪ Hypo/Hypertension	16	0.9	4.5
▪ Postoperative Pulmonary Compromise	14	0.8	5.0
▪ Postoperative Stroke/Anoxic Brain Damage	10	0.6	7.5
▪ Postoperative Cardiac Complications	9	0.5	6.1
▪ Postoperative Pneumonia	6	0.3	6.8
▪ Postoperative Venous Thrombosis/Pulmonary Embolism	5	0.3	2.4
▪ Device, Implant or Graft Complications	5	0.3	2.8
▪ Postoperative Infection	1	0.1	7.0
▪ Gastric/Intestinal Hemorrhage or Ulceration	0	0.0	NA
▪ Death	0	0.0	NA
Any Complication Above	***150***	***8.3***	***4.4***
Without Any Complication Above	***1,665***	***91.7***	***2.9***

†The term "cases" refers to hospitalizations after exclusions.
NA: Not Applicable

Definition of In-Hospital Complications for Surgical Procedures

The following ICD-9-CM codes were used to define in-hospital complications for Hysterectomy (Abdominal and Vaginal), Breast Cancer Procedures (Mastectomy), Neck and Back Procedures (With Fusion and Without Fusion) and Prostatectomy. Exceptions are noted.

Procedure/Medical Care Related Events *The following codes were analyzed for all surgical procedures.*

995.4	998.2	998.32	998.7	998.9	999.7
995.86		998.4	998.83	999.2	999.8
995.89	998.31	998.6	998.89	999.6	999.9
998.0					

Digestive System Complications *The following code was analyzed for all surgical procedures.*

997.4

Postoperative Pulmonary Compromise *The following codes were analyzed for all surgical procedures.*

31.1 (Procedure)	512.1	518.4	518.6	518.82	997.3
31.21 (Procedure)	514	518.5	518.81	518.84	998.81
31.29 (Procedure)					

Lymphedema *The following code was analyzed for Breast Cancer Procedures only.*

457.0

Postoperative Hemorrhage *The following codes were analyzed for all surgical procedures.*

39.98 (Procedure)	998.11	998.12	998.13

The following code was analyzed for Hysterectomy and Prostatectomy only.

57.93 (Procedure)

Postoperative Infection

The following codes were analyzed for all surgical procedures.

038.0	038.2	038.42	038.8	995.92	996.64
038.10	038.3	038.43	038.9	995.93	998.51
038.11	038.40	038.44	995.90	995.94	998.59
038.19	038.41	038.49	995.91	996.62	999.3

The following code was analyzed for Hysterectomy, Breast Cancer Procedures, and Prostatectomy only.

996.60

The following code was analyzed for Hysterectomy and Prostatectomy only.

996.65

The following code was analyzed for Breast Cancer Procedures only.

996.69

The following codes were analyzed for Neck and Back Procedures only.

996.63	996.66	996.67

Postoperative Pneumonia *Coded by causative organism. The following codes were analyzed for all surgical procedures.*

481	482.30	482.40	482.82	482.9	485
482.0	482.31	482.41	482.83	483.0	486
482.1	482.32	482.49	482.84	483.1	
482.2	482.39	482.81	482.89	483.8	

Postoperative Cardiac Complications *The following codes were analyzed for all surgical procedures.*

410.01	410.21	410.41	410.61	410.81	997.1
410.11	410.31	410.51	410.71	410.91	

Postoperative Venous and Arterial Thrombosis/Pulmonary Embolism *The following codes were analyzed for all surgical procedures.*

415.11	451.11	451.81	997.2	997.72	999.1
415.19	451.19	453.8	997.71	997.79	

Hypotension/Hypertension *The following codes were analyzed for all surgical procedures.*

458.29	997.91

Postoperative Stroke/Anoxic Brain Damage *The following codes were analyzed for all surgical procedures.*

348.1	432.1	433.21	433.91	434.91	997.01
430	432.9	433.31	434.01	436	997.02
431	433.01	433.81	434.11	997.00	997.09
432.0	433.11				

Device, Implant, or Graft Complications

The following codes were analyzed for all surgical procedures.

996.31	996.74

The following codes were analyzed for Hysterectomy and Prostatectomy only.

996.30	996.39	996.76

The following code was analyzed for Breast Cancer Procedures and Neck and Back Procedures only.

996.52

The following codes were analyzed for Breast Cancer Procedures only.

996.54	996.55	996.70	996.79

The following codes were analyzed for Neck and Back Procedures only.

996.4	996.75	996.77	996.78

Gastric/Intestinal Hemorrhage or Ulceration

The following codes were analyzed for all surgical procedures.

531.00	531.41	532.20	533.01	533.60	534.21
531.01	531.60	532.21	533.10	533.61	534.40
531.10	531.61	532.40	533.11	534.00	534.41
531.11	532.00	532.41	533.20	534.01	534.60
531.20	532.01	532.60	533.21	534.10	534.61
531.21	532.10	532.61	533.40	534.11	537.84
531.40	532.11	533.00	533.41	534.20	578.9

The following code was analyzed for Hysterectomy and Prostatectomy only.

49.95 (Procedure)

Death Discharge Status Code 20 was included as a complication for all surgical procedures.

Pediatric Ear, Nose and Throat Infections

Cases age 0 through 17

Hospitalization Rate	**HMO Inpatient Cases* (N = 408)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	217	53.2
5 –17 years	191	46.8
• Sex		
Female	173	42.4
Male	235	57.6

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Adult Ear, Nose and Throat Infections

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 468)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	301	64.3
45 – 64 years	167	35.7
• Sex		
Female	259	55.3
Male	209	44.7

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

High Blood Pressure (Hypertension)

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 542)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	140	25.8
45 – 64 years	402	74.2
• Sex		
Female	288	53.1
Male	254	46.9

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Gastrointestinal Infections

Cases age 0 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,062)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	128	12.1
5 – 17 years	106	10.0
18 – 44 years	414	39.0
45 – 64 years	414	39.0
• Sex		
Female	659	62.1
Male	403	37.9

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Kidney/Urinary Tract Infections

Cases age 0 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,304)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	149	11.4
5 – 17 years	119	09.1
18 – 44 years	513	39.3
45 – 64 years	523	40.1
• Sex		
Female	1,034	79.3
Male	270	20.7

**Cases after hospitalization rate exclusions; comparative reference = HMO database*

Chronic Obstructive Pulmonary Disease

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 857)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	44	5.1
45 – 64 years	813	94.9
• Sex		
Female	523	61.0
Male	334	39.0
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,168)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Age			
0 – 50	221	18.9	3.2
51 – 54	190	16.3	3.8
55 – 59	347	29.7	4.1
60 – 61	180	15.4	4.1
62 +	230	19.7	4.2
• *Atlas Outcomes™* MQPredLOS			
0 – 3.732 days	233	19.9	3.1
3.733 – 4.181 days	234	20.0	3.5
4.182 – 4.600 days	234	20.0	3.8
4.601 – 5.261 days	234	20.0	4.0
5.262 + days	233	19.9	5.0
**Cases after LOS exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

Rehospitalizations (Rehosp)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,142**)		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Rehospitalized*
• *Atlas Outcomes™* MQPredLOS			
0 – 3.739 days	228	20.0	15.4
3.740 – 4.181 days	228	20.0	21.5
4.182 – 4.600 days	230	20.1	19.6
4.601 – 5.259 days	228	20.0	20.6
5.260 + days	228	20.0	28.1
• Median Household Income			
$0 - 30,539	227	19.9	22.9
$30,540 - 35,309	228	20.0	23.2
$35,310 - 41,030	230	20.1	20.4
$41,031 - 50,100	229	20.1	21.4
$50,101 +	228	20.0	17.1
**Cases after rehospitalization exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

Chronic Obstructive Pulmonary Disease *continued*

LOS	***Rehosp***	***Significant Risk Factors Used for Length of Stay and Rehospitalizations***
✓		• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes*^{TM} Predicted Length of Stay (MQPredLOS)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Female (no, yes)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• High Poverty (high, average, very high; based on zip code)
	✓	• Median Household Income (based on zip code)
		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes*^{TM} Predicted Probability of Death [MQPredDeath])
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

Pediatric Asthma

Cases age 0 through 17

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,172)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
0 – 4 years	492	42.0
5 – 17 years	680	58.0
• Sex		
Female	432	36.9
Male	740	63.1
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,402)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 2.004 days	121	8.6	1.7
2.005 – 2.079 days	767	54.7	1.9
2.080 – 2.422 days	235	16.8	1.8
2.423 +	279	19.9	2.4
• Age			
0 – 0 year	75	5.3	2.1
1 – 2 years	365	26.0	1.8
3 – 6 years	427	30.5	1.8
7 – 11 years	313	22.3	2.1
12 – 17 years	222	15.8	2.3
• Female			
No	873	62.3	1.9
Yes	529	37.7	2.1
**Cases after LOS exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

LOS	***Significant Risk Factors Used for Length of Stay***
✓	• Age
	• Age-Squared
	• Asthma with Status Asthmaticus/Acute Exacerbation (no, yes: 493.01, 493.02, 493.11, 493.12, 493.21, 493.22, 493.91, 493.92)
✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
✓	• Female (no, yes)
	• Median Household Income (based on zip code)
	• Poverty Rate (based on zip code)
	• Race (Black, Other, White)

Adult Asthma

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,627)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	705	43.3
45 – 64 years	922	56.7
• Sex		
Female	1,203	73.9
Male	424	26.1
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Adult Asthma *continued*

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 2,039)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 2.693 days	407	20.0	2.4
2.694 – 3.189 days	407	20.0	2.7
3.190 – 3.618 days	410	20.1	3.4
3.619 – 4.223 days	408	20.0	3.7
4.224 + days	407	20.0	4.3
• Chronic Obstructive Asthma			
No	1,478	72.5	3.0
Yes	561	27.5	4.0
• Psychological Disorder			
No	1,654	81.1	3.2
Yes	385	18.9	3.9
• Asthma with Status Asthmaticus/Acute Exacerbation			
No	217	10.6	2.8
Yes	1,822	89.4	3.4
• *Female*			
No	532	26.1	2.8
Yes	1,507	73.9	3.5
• *Age*			
0-33	388	19.0	2.5
34-42	400	19.6	3.1
43-50	483	23.7	3.3
51-56	387	19.0	3.7
57+	381	18.7	4.0
**Cases after LOS exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

Rehospitalizations (Rehosp)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,985)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Rehospitalized*
• *Atlas Outcomes™* PredLOS			
0 - 2.704 days	394	19.8	9.6
2.705 - 3.199 days	400	20.2	13.0
3.200 - 3.627 days	397	20.0	12.6
3.628 - 4.227 days	397	20.0	14.9
4.228 + days	397	20.0	19.9
• Asthma with Status Asthmaticus/Acute Exacerbation			
No	214	10.8	8.9
Yes	1,771	89.2	14.6
• Median Household Income			
$0 – 29,120	403	20.3	16.6
$29,130 – 34,920	400	20.2	14.3
$34,930 – 39,410	392	19.7	14.5
$39,420 – 48,420	395	19.9	12.9
$48,430+	395	19.9	11.6
• Chronic Obstructive Asthma			
No	1,436	72.3	12.5
Yes	549	27.7	18.0
**Cases after rehospitalization exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

LOS	***Rehosp***	***Significant Risk Factors Used for Length of Stay and Rehospitalizations***
✓		• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
✓	✓	• Asthma with Status Asthmaticus/Acute Exacerbation (no, yes: 493.01, 493.02, 493.11, 493.12, 493.21, 493.22, 493.91, 493.92)
✓	✓	• Chronic Obstructive Asthma (no, yes: 493.20-493.22)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
✓		• Female (no, yes)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
	✓	• Median Household Income (based on zip code)
		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
✓		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

Diabetes

Cases age 18 through 75

Hospitalization Rate	**HMO Inpatient Cases* (N = 1,199)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 25 years	100	8.3
26 – 35 years	113	9.4
36 – 45 years	219	18.3
46 – 55 years	383	31.9
56 – 65 years	331	27.6
66 – 75 years	53	4.4
• Sex		
Female	529	44.1
Male	670	55.9
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,626)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 2.716 days	325	20.0	2.3
2.717 – 3.399 days	325	20.0	2.6
3.400 – 4.376 days	326	20.0	3.2
4.377 – 6.310 days	325	20.0	4.0
6.311 + days	325	20.0	7.4
• Amputation			
No	1,455	89.5	3.3
Yes	171	10.5	9.1
• Renal Dialysis			
No	1,559	95.9	3.8
Yes	67	4.1	7.0
• Female			
No	928	57.1	4.0
Yes	698	42.9	3.8
• Heart Failure			
No	1,513	93.1	3.8
Yes	113	6.9	6.0
• Diabetic Complications			
Long Term	729	44.8	5.0
None	86	5.3	2.4
Short Term	811	49.9	3.1
**Cases after LOS exclusions; comparative reference = HMO and Fee-for-Service combined databases*			

Diabetes *continued*

Rehospitalizations (Rehosp)	**HMO and Fee-for-Service Inpatient Cases* (N = 1,576)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Rehospitalized*
• *Atlas Outcomes™* PredLOS			
0 - 2.708 days	314	19.9	7.3
2.709 - 3.392 days	316	20.1	9.2
3.393 - 4.342 days	316	20.1	13.9
4.343 - 6.315 days	315	20.0	15.6
6.316 days +	315	20.0	20.0
• Age			
0-36 years	313	19.9	13.7
37-45 years	287	18.2	15.7
46-53 years	375	23.8	13.9
54-59 years	315	20.0	13.0
60+ years	286	18.1	9.4
• Female			
No	895	56.8	10.9
Yes	681	43.2	16.2
• Psychological Disorder			
No	1,391	88.3	12.3
Yes	185	11.7	20.0
• Peripheral Vascular Disease			
No	1,521	96.5	12.7
Yes	55	3.5	27.3
• Medical DRG			
No	168	10.7	15.5
Yes	1,408	89.3	12.9
• Long Term Diabetes Complications			
No	865	54.9	10.8
Yes	711	45.1	16.2

**Cases after rehospitalization exclusions; comparative reference = HMO and Fee-for-Service combined databases*

LOS	***Rehosp***	***Significant Risk Factors Used for Length of Stay and Rehospitalizations***
	✓	• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Cardiomyopathy (no, yes: 425.3, 425.4, 425.8, 425.9)
		• COPD (no, yes: 491.20, 491.21, 492.0, 492.8, 496, 506.4, 518.2)
✓	✓	• Diabetes Complications (long-term: 250.4x-250.9x, x=0-3; none: 250.00, 250.01; short-term: 250.02, 250.03, 250.1x-250.3x, x=0-3)
✓	✓	• Female (no, yes)
✓		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Ischemic Heart Disease (no, yes: 411.0, 411.1, 411.81, 411.89, 412, 413.0, 413.1, 413.9, 414.00, 414.01, 414.02, 414.03, 414.04, 414.05, 414.06, 414.10, 414.07**, 414.11, 414.12, 414.19, 414.8, 414.9)
✓		• Lower Extremity Amputation—non-traumatic (no, yes: procedure codes 84.10-84.17; exclude diagnosis codes 895.x, x=0,1; 896.x, x=0-3; 897.x, x=0-7)
		• Malignant Cancer (no, yes: 140.0-208.9, 230.0-239.9)
		• Median Household Income (based on zip code)
	✓	• Medical DRG (no, yes)
		• Obesity (no, yes: 278.00, 278.01)
	✓	• Peripheral Vascular Disease (no, yes: 443.0, 443.1, 443.81, 443.89, 443.9)
		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
	✓	• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
✓		• Renal Dialysis (no, yes: V45.1, V56.0, V56.8; procedure codes 39.95, 54.98)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

Heart Attack (AMI)

Cases age 18 through 64

Hospitalization Rate	**HMO Inpatient Cases* (N = 2,498)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	297	11.8
45 – 64 years	2,201	88.1
• Sex		
Female	632	25.3
Male	1,866	74.7
**Cases after hospitalization rate exclusions; comparative reference = HMO database*		

Number of Days Hospitalized (AvgDays)	**Statewide Inpatient Cases* (N = 10,823)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. # Days Hospitalized*
• *Atlas Outcomes™* PredLOS			
0 – 2.809 days	2,164	20.0	4.0
2.810 – 3.639 days	2,162	20.0	4.9
3.640 – 4.528 days	2,170	20.0	5.3
4.529 – 6.033 days	2,163	20.0	6.3
6.034 + days	2,164	20.0	9.8
• Heart Failure			
No	9,303	86.0	5.4
Yes	1,520	14.0	10.3
• Age			
18 – 46	2,071	19.1	5.0
47 – 52	1,995	18.4	5.5
53 – 57	2,545	23.5	5.9
58 – 61	2,203	20.4	6.7
62 +	2,009	18.6	7.3
• Diabetes			
No	8,120	75.0	5.7
Yes	2,703	25.0	7.2
• Female			
No	7,882	72.8	5.8
Yes	2,941	27.2	6.9
• Poverty Rate			
0 – 4.9590%	2,185	20.2	5.5
4.9591 – 7.7688%	2,141	19.8	6.0
7.7689 – 10.6181%	2,170	20.0	6.1
10.6182 – 15.6198%	2,153	19.9	6.1
15.6199% +	2,174	20.1	6.6
• Alcohol/Drug Abuse			
No	10,221	94.4	6.0
Yes	602	5.6	6.8
**Cases after Number of Days hospitalized exclusions; comparative reference = Statewide database*			

Heart Attack (AMI) *continued*

In-Hospital Mortality (Mort)	**Statewide Inpatient Cases* (N = 11,245)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Mortality*
• Predicted Death (Logit of MQPredDeath)			
0 – 0.005	1,808	16.1	0.1
0.006 – 0.008	2,316	20.6	0.1
0.009 – 0.014	2,822	25.1	0.6
0.015 – 0.025	2,088	18.6	2.1
0.026 +	2,211	19.7	11.5
• Renal Dialysis			
No	11,066	98.4	2.6
Yes	179	1.6	16.2
• AMI Type I (Q-wave)			
No	5,395	48.0	1.8
Yes	5,850	52.0	3.8
• Heart Failure			
No	9,541	84.8	2.0
Yes	1,704	15.2	7.5
**Cases after in-hospital mortality exclusions; comparative reference = Statewide database*			

AvgDays	***Mort***	***Significant Risk Factors Used for Average Number of Days and In-Hospital Mortality***
✓		• Age
		• Age-Squared
✓		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
	✓	• AMI Type I (Q-wave) (no, yes: 410.x1, x = 0-6, 8-9)
		• AMI Type II (Anterior) (no, yes: 410.01, 410.11)
✓		• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Cardiomyopathy (no, yes: 425.3, 425.4, 425.8, 425.9)
✓		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
✓		• Female (no, yes)
✓	✓	• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of CABG (no, yes: V45.81, 414.02, 414.03, 414.04, 414.05, 996.03)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
✓		• Poverty Rate (based on zip code)
	✓	• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
	✓	• Renal Dialysis (no, yes: V45.1, V56.0, V56.8; procedure codes 39.95, 54.98)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

Hysterectomy (Abdominal and Vaginal)

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 6,229)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	3,000	48.2
45 – 64 years	3,229	51.8
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Hysterectomy – Abdominal

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 4,337)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	2,070	47.7
45 – 64 years	2,267	52.3
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 13,195)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 2.604 days	2,638	20.0	2.5
2.605 – 2.717 days	2,613	19.8	2.5
2.718 – 2.871 days	2,673	20.3	2.6
2.872 – 3.106 days	2,639	20.0	2.7
3.107 + days	2,632	19.9	3.2
• Poverty Rate			
0 – 4.7287%	2,634	20.0	2.6
4.7288 – 7.5189%	2,625	19.9	2.6
7.5190 – 10.3023%	2,635	20.0	2.7
10.3024 – 15.1123%	2,650	20.1	2.7
15.1124% +	2,651	20.1	2.9
• Radical			
No	13,264	99.8	2.7
Yes	28	00.2	3.3
• Age			
0 – 37	2,246	17.0	2.6
38 – 42	3,018	22.9	2.7
43 – 46	3,193	24.2	2.7
47 – 50	2,551	19.3	2.7
51 +	2,187	16.6	2.8
**Cases after LOS exclusions; comparative reference = Statewide database*			

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 13,212**)		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complications*
• *Atlas Outcomes™* PredLOS			
0 – 2.604 days	2,638	20.0	6.2
2.605 – 2.717 days	2,614	19.8	6.3
2.718 – 2.871 days	2,720	20.6	6.5
2.872 – 3.106 days	2,599	19.7	7.9
3.107 + days	2,641	20.0	18.1
• Poverty Rate			
0 – 4.7287%	2,639	20.0	8.5
4.7288 – 7.5189%	2,626	19.9	9.2
7.5190 – 10.3023%	2,736	20.0	8.9
10.3024 – 15.1123%	2,753	20.1	7.3
15.1124% +	2,758	20.1	11.1
**Cases after in-hospital complications exclusions; comparative reference = Statewide database*			

Hysterectomy – Abdominal *continued*

LOS	*Compl*	*Significant Risk Factors Used for Length of Stay and In-Hospital Complications*
✔		• Age
✔		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✔	✔	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Female Reproductive Cancer (no, yes: V10.40-V10.44)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
✔	✔	• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
		• Principal Diagnosis Group (fibroids/hyperplasia/endometriosis/uterine prolapse: 218.x, x=0-9; 621.2; 621.3; 617.x, x=0-9; 618.1-618.4; bleeding abnormalities and other principal diagnoses: 626.2-626.9, 627.0, 627.1)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
✔		• Radical Hysterectomy (no, yes: 68.6, 68.7)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)

Hysterectomy – Vaginal

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 1,892)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	930	49.2
45 – 64 years	962	50.8
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 5,793)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 1.724 days	1,140	19.7	1.5
1.725 – 1.848 days	1,176	20.3	1.6
1.849 – 1.971 days	1,161	20.0	1.6
1.972 – 2.165 days	1,160	20.0	1.7
2.166 + days	1,156	20.0	1.9
• Laparoscopic Procedure			
No	3,866	66.7	1.7
Yes	1,927	33.3	1.5
• Age			
18 – 36 years	1,020	17.6	1.6
37 – 41 years	1,136	19.6	1.6
42 – 46 years	1,462	25.2	1.6
47 – 52 years	1,072	18.5	1.7
53 – 64 years	1,103	19.0	1.9
• Poverty Rate			
0 – 4.8347%	1,148	19.8	1.7
4.8348 – 7.5272%	1,169	20.2	1.6
7.5273– 10.2233%	1,155	19.9	1.6
10.2234 – 13.6147%	1,161	20.0	1.6
13.6148% +	1,160	20.0	1.8
• Principal Diagnosis Group			
Bleeding/Other	2,198	37.9	1.6
Fibroids/Hyperplasia/Endometriosis/ Uterine Prolapse	3,595	62.1	1.7
**Cases after LOS exclusions; comparative reference = Statewide database*			

Hysterectomy – Vaginal *continued*

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 5,795)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complications*
• *Atlas Outcomes™* PredLOS			
0 – 1.724 days	1,140	19.7	3.2
1.725 – 1.848 days	1,176	20.3	3.0
1.849 – 1.972 days	1,167	20.1	4.9
1.973 – 2.165 days	1,154	19.9	4.5
2.166 + days	1,158	20.0	11.4
• Median Household Income			
$0 – 31,580	1,167	20.1	4.4
$31,590 – 35,800	1,151	19.9	5.4
$35,810 – 40,900	1,158	20.0	5.8
$40,910 – 49,650	1,169	20.2	5.4
$49,660+	1,150	19.8	6.1
• Principal Diagnosis Group			
Bleeding/Other	2,199	37.9	5.7
Fibroids/Hyperplasia/Endometriosis/ Uterine Prolapse	3,596	62.1	5.2

**Cases after in-hospital complications exclusions; comparative reference = Statewide database*

LOS	***Compl***	***Significant Risk Factors Used for Length of Stay and In-Hospital Complications***
✓		• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Female Reproductive Cancer (no, yes: V10.40-V10.44)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
✓		• Laparoscopic Procedure (no, yes: 68.51)
	✓	• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
✓		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
✓	✓	• Principal Diagnosis Group (fibroids/hyperplasia/endometriosis/uterine prolapse: 218.x, x=0-9; 621.2; 621.3; 617.x, x=0-9; 618.1-618.4; bleeding abnormalities and other principal diagnoses: 626.2-626.9, 627.0, 627.1)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)

Breast Cancer Procedures (Lumpectomy and Mastectomy)

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 2,510)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	503	20.0
45 – 64 years	2,007	80.0
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Breast Cancer Procedures – Lumpectomy

Cases age 18 through 64

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 488)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
1.576 – 1.712 days	179	36.7	1.2
1.713 – 1.816 days	141	28.9	1.2
1.817 – 2.040 days	71	14.5	1.2
2.041 + days	97	19.9	1.6
• Poverty Rate			
0 – 3.8739%	97	19.9	1.1
3.8740 – 6.6106%	98	20.1	1.2
6.6107 – 10.0487%	96	19.7	1.4
10.0488 – 16.8607%	100	20.5	1.2
16.8608% +	97	19.9	1.5
• Breast Cancer Type			
In Situ	32	6.6	1.4
Malignant Neoplasm	253	51.8	1.3
Metastatic Cancer	203	41.6	1.2
• Age			
0-44 years	87	17.8	1.1
45-50 years	101	20.7	1.2
51-55 years	110	22.5	1.2
56-60 years	96	19.7	1.5
61+	94	19.3	1.4
**Cases after LOS exclusions; comparative reference = Statewide database*			

LOS		***Significant Risk Factors Used for Length of Stay and In-Hospital Complications***
✓		• Age
		• Age-Squared
		• Alcohol & Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓		• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
✓		• Breast Cancer Type (malignant: 174.0-174.9, 238.3, 239.3; in situ: 233.0; metastatic: 196.3, 198.2, 198.81)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Family History of Breast Cancer (no, yes: V16.3)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Breast Cancer (no, yes: V10.3)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
✓		• Poverty Rate (based on zip code)
■		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Reconstruction–Concurrent (no, yes: procedure codes 85.50-85.54, 85.7, 85.82-85.87, 85.93, 85.96)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Subtotal Mastectomy (no, yes: procedure codes 85.23, CPT 19160, CPT 19162)

Breast Cancer Procedures – Mastectomy

Cases age 18 through 64

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 1,979)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Reconstruction–Concurrent			
No	1,479	74.7	1.8
Yes	500	25.3	3.7
• *Atlas Outcomes™* PredLOS			
1.576 – 1.712 days	752	38.0	2.2
1.713 – 1.816 days	436	22.0	2.3
1.817 – 2.091 days	398	20.1	2.1
2.092 + days	393	19.9	2.5
• Diabetes			
No	1,830	92.5	2.2
Yes	149	7.5	2.5
**Cases after LOS exclusions; comparative reference = Statewide database*			

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 1,980)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complication*
• Reconstruction–Concurrent			
No	1,479	74.7	3.4
Yes	501	25.3	10.0
• *Atlas Outcomes™* PredLOS			
1.576 – 1.712 days	752	38.0	4.3
1.713 – 1.816 days	436	22.0	3.2
1.817 – 2.091 days	399	20.2	5.3
2.092 + days	393	19.8	8.4
** Cases after in-hospital complications exclusions; comparative reference = Statewide database*			

LOS	***Compl***	***Significant Risk Factors Used for Length of Stay and In-hospital Complications***
		• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Breast Cancer Type (malignant: 174.0-174.9, 238.3, 239.3; in situ: 233.0; metastatic: 196.3, 198.2, 198.81)
✓		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Family History of Breast Cancer (no, yes: V16.3)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Breast Cancer (no, yes: V10.3)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
		• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
		• Procedure Group (simple mastectomy: procedure codes 85.41-85.44, CPT19180; radical mastectomy: procedure codes 85.45-85.48, CPT 19200, CPT 19220, CPT 19240)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
✓	✓	• Reconstruction–Concurrent (no, yes: procedure codes 85.50-85.54, 85.7, 85.82-85.87, 85.93, 85.96)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)

Neck and Back Procedures (With Fusion and Without Fusion)

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 5,118)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	2,009	39.3
45 – 64 years	3,109	60.7
• Sex		
Female	2,470	48.3
Male	2,648	51.7
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Neck and Back Procedures With Fusion

Cases age 18 through 64

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 6,244)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• Fusion Location			
Cervical/Atlas-Axis	4,303	68.9	1.6
Dorsal and Dorsolumbar	47	0.8	5.6
Lumbar and Lumbosacral	1,894	30.3	3.8
• *Atlas Outcomes™* PredLOS			
0 – 1.591 days	981	15.7	1.5
1.592 – 1.876 days	1,504	24.1	1.7
1.877 – 2.406 days	1,266	20.3	2.1
2.407 – 2.981 days	1,245	19.9	2.5
2.982 + days	1,248	20.0	3.5
• Principal Diagnosis Group			
Disc Degeneration	632	10.1	3.0
Disc Displacement	3,127	50.1	1.8
Narrowing of the Spinal Canal	1,876	30.0	2.8
Other Disc Disorders/Back Pain	609	9.8	2.4
• Poverty Rate			
0 – 4.6380%	1,258	20.1	2.2
4.6381 – 7.3340%	1,237	19.8	2.3
7.3341 – 10.0849%	1,280	20.5	2.3
10.0850 – 14.3027%	1,206	19.3	2.1
14.3028% +	1,263	20.2	2.5
• Alcohol/Drug Abuse			
No	6,162	98.7	2.3
Yes	82	1.3	3.6
• Age			
18 – 38	1,137	18.2	2.2
39 – 43	1,094	17.5	2.1
44 – 49	1,528	24.5	2.1
50 – 55	1,286	20.6	2.3
56 +	1,199	19.2	2.8
**Cases after LOS exclusions; comparative reference = Statewide database*			

Neck and Back Procedures With Fusion *continued*

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 6,258)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complication*
• Fusion Location			
Cervical/Atlas-Axis	4,311	68.9	2.8
Dorsal and Dorsolumbar	49	0.8	24.5
Lumbar and Lumbosacral	1,898	30.3	12.2
• *Atlas Outcomes™* PredLOS			
0 – 1.591 days	982	15.7	3.5
1.592 – 1.880 days	1,519	24.3	4.1
1.881 – 2.409 days	1,254	20.0	4.5
2.410 – 2.987 days	1,252	20.0	5.7
2.988 + days	1,251	20.0	11.0
• Principal Diagnosis Group			
Disc Degeneration	632	10.1	9.3
Disc Displacement	3,128	50.0	3.7
Narrowing of the Spinal Canal	1,883	30.1	7.9
Other Disc Disorders/Back Pain	615	9.8	6.2
• Female			
No	3,090	49.4	6.1
Yes	3,168	50.6	5.5
• Obesity			
No	5,887	94.1	5.6
Yes	371	5.9	9.4
• Age			
18 - 38	1,138	18.2	4.7
39 – 43	1,096	17.5	5.7
44 – 49	1,529	24.4	4.0
50 – 55	1,288	20.6	6.2
56 +	1,207	19.3	8.7
• *Median Household Income*			
$0 – 31,880	1,249	20.0	7.0
$31,890 – 36,290	1,255	20.1	6.1
$36,300 – 42,250	1,242	19.8	5.3
$42,260 – 50,630	1,271	20.3	5.5
$50,640 +	1,241	19.8	5.0

** Cases after in-hospital complications exclusions; comparative reference = Statewide database*

LOS	***Compl***	***Significant Risk Factors Used for Length of Stay and In-Hospital Complications***
✓	✓	• Age
✓		• Age-Squared
✓		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✓	✓	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Cancer (malignant/in situ: 140.0-208.9, 230.0-239.9; history: V10.00-V10.9)
		• COPD (no, yes: 491.20, 491.21, 492.0, 492.8, 496, 506.4, 518.2)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
	✓	• Female (no, yes)
✓	✓	• Fusion Location (cervical/atlas-axis: procedure codes 81.00, 81.01, 81.02, 81.03; dorsal and dorsolumbar: procedure codes 81.04, 81.05; lumbar and lumbosacral: procedure codes 81.06, 81.07, 81.08)
		• Fusion Technique (anterior: procedure codes 81.00, 81.01, 81.02, 81.04, 81.06; posterior/lateral: procedure codes 81.03, 81.05, 81.07, 81.08; multiple: procedure code 81.61, 81.62, 81.63, 81.64, 2 or more procedure codes)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
	✓	• Median Household Income (based on zip code)
		• Musculoskeletal Disorders (no, yes: 274.0, 274.10, 274.11, 274.19, 274.81, 274.82, 274.89, 274.9, 710.0x, x=0-9; 712.x, x=0-9; 713.x, x=0-8; 714.x, x=0-9; 715.x x=0-9; 733.0x, x=0-9; V43.6x, x=0-9)
	✓	• Obesity (no, yes: 278.00, 278.01)
✓		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
✓	✓	• Principal Diagnoses Group (disc displacement: 722.0, 722.10, 722.11, 722.2; narrowing of spinal canal: 720.0, 721.0-721.42, 721.90, 721.91, 723.0, 724.00-724.09, 738.4, 756.11, 756.12; disc degeneration: 722.4, 722.51, 722.52, 722.6; other disc disorders/back pain: 722.70-722.73, 722.90-722.93, 723.1, 724.1-724.3, 724.5)
		• Procedure Group (discectomy: procedure codes 80.50, 80.51, 80.59; laminectomy: procedure codes 03.09; discectomy and laminectomy: procedure codes 80.50, 80.51 or 80.59 and 03.09)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)

		• Tobacco Use (no, yes: 305.1, V15.82)

Neck and Back Procedures Without Fusion

Cases age 18 through 64

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 9,328)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 – 1.420 days	1,622	17.4	1.2
1.421 – 1.632 days	2,097	22.5	1.4
1.633 – 1.871 days	1,894	20.3	1.5
1.872 – 2.311 days	1,851	19.8	1.7
2.312 + days	1,864	20.0	2.7
• Principal Diagnosis Group			
Disc Degeneration	132	1.4	1.9
Disc Displacement	6,675	71.6	1.5
Narrowing of Spinal Canal	2,289	24.5	2.1
Other Disc Disorders/Back Pain	232	2.5	2.4
• Poverty Rate			
0 – 4.4195%	1,869	20.0	1.6
4.4196 – 7.1023%	1,864	20.0	1.7
7.1024 – 9.8492%	1,859	19.9	1.7
9.8493 – 13.4046%	1,875	20.1	1.6
13.4047% +	1,861	20.0	1.9
• Female			
No	5,378	57.7	1.6
Yes	3,950	42.3	1.8
• Procedure Group			
Both Discectomy and Laminectomy	582	6.2	2.1
Discectomy	6,436	69.0	1.5
Laminectomy	2,310	24.8	2.0
• Age			
18 – 35 years	1,830	19.6	1.4
36 – 42 years	1,809	19.4	1.5
43 – 49 years	2,063	22.1	1.6
50 – 56 years	1,978	21.2	1.9
57 – 64 years	1,648	17.7	2.1

**Cases after LOS exclusions; comparative reference = Statewide database*

In-Hospital Complications (comp)	**Statewide Inpatient Cases* (N = 9,338)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complication*
• Principal Diagnosis Group			
Disc Degeneration	132	1.4	9.1
Disc Displacement	6,678	71.5	3.7
Narrowing of Spinal Canal	2,292	24.5	7.3
Other Disc Disorders/Back Pain	236	2.5	7.6
• *Atlas Outcomes™* PredLOS			
0 – 1.420 days	1,622	17.4	2.7
1.421 – 1.632 days	2,098	22.5	3.5
1.633 – 1.871 days	1,894	20.3	4.4
1.872 – 2.313 days	1,857	19.9	5.8
2.314 + days	1,867	20.0	7.3
• Age			
18 – 35 years	1,831	19.6	3.4
36 – 42 years	1,810	19.4	3.9
43 – 49 years	2,064	22.1	4.1
50 – 56 years	1,981	21.2	5.4
57 – 64 years	1,652	17.7	7.3
• Median Household Income			
$0 – 32,060	1,860	19.9	5.6
$32,070 – 36,890	1,888	20.2	4.9
$36,900 – 43,630	1,838	19.7	4.1
$43,640 – 52,730	1,893	20.3	4.7
$52,740 +	1,859	19.9	4.5

** Cases after in-hospital complications exclusions; comparative reference = Statewide database*

Neck and Back Procedures Without Fusion *continued*

LOS	*Compl*	*Significant Risk Factors Used for Length of Stay and In-Hospital Complications*
✔	✔	• Age
✔		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✔	✔	• *Atlas Outcomes™* Predicted Length of Stay (MQPredLOS)
		• Cancer (malignant/in situ: 140.0-208.9, 230.0-239.9; history: V10.00-V10.9)
		• COPD (no, yes: 491.20, 491.21, 492.0, 492.8, 496, 506.4, 518.2)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
✔		• Female (no, yes)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
	✔	• Median Household Income (based on zip code)
		• Musculoskeletal Disorders (no, yes: 274.0, 274.10, 274.11, 274.19, 274.81, 274.82, 274.89, 274.9, 710.0x, x=0-9; 712.x, x=0-9; 713.x, x=0-8; 714.x, x=0-9; 715.x x=0-9; 733.0x, x=0-9; V43.6x, x=0-9)
		• Obesity (no, yes: 278.00, 278.01)
✔		• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes™* Predicted Probability of Death [MQPredDeath])
✔	✔	• Principal Diagnoses Group (disc displacement: 722.0, 722.10, 722.11, 722.2; narrowing of spinal canal: 720.0, 721.0-721.42, 721.90, 721.91, 723.0, 724.00-724.09, 738.4, 756.11, 756.12; disc degeneration: 722.4, 722.51, 722.52, 722.6; other disc disorders/back pain: 722.70-722.73, 722.90-722.93, 723.1, 724.1-724.3, 724.5)
✔		• Procedure Group (discectomy: procedure codes 80.50, 80.51, 80.59; laminectomy: procedure code 03.09; discectomy and laminectomy: procedure codes 80.50, 80.51 or 80.59 and 03.09)
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)
		• Tobacco Use (no, yes: 305.1, V15.82)

Prostatectomy

Cases age 18 through 64

Procedure Rate	**HMO Inpatient Cases* (N = 587)**	
Significant Variable	*Number of Cases*	*Percent of Total*
• Age		
18 – 44 years	6	1.0
45 – 64 years	581	99.0
**Cases after procedure rate exclusions; comparative reference = HMO database*		

Length of Stay (LOS)	**Statewide Inpatient Cases* (N = 1,811)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*Avg. LOS*
• *Atlas Outcomes™* PredLOS			
0 –2.954 days	360	19.9	2.9
2.955 – 3.037 days	305	16.8	2.8
3.038 – 3.247days	422	23.3	2.8
3.248 – 3.622 days	362	20.0	3.0
3.623 + days	362	20.0	3.3
• Hypertension			
No	1,069	59.0	2.9
Yes	742	41.0	3.1
• Median Household Income			
$0 – 31,820	363	20.0	3.3
$31,830 – 38,240	363	20.0	3.1
$38,250 – 45,490	360	19.9	2.9
$45,500 – 55,210	362	20.0	2.9
$55,220 +	363	20.0	2.7
**Cases after LOS exclusions; comparative reference = Statewide database*			

In-Hospital Complications (Compl)	**Statewide Inpatient Cases* (N = 1,815)**		
Significant Variable	*Number of Cases*	*Percent of Total*	*% Complication*
• *Atlas Outcomes™* PredLOS			
0 –2.958 days	363	20.0	5.8
2.959 – 3.037 days	302	16.6	7.6
3.038 – 3.249 days	425	23.4	6.4
3.250 – 3.622 days	363	20.0	9.4
3.623 + days	362	19.9	12.4

In-Hospital Complications for Prostatectomy Continued:			
• Poverty Rate			
0 – 4.0928%	361	19.9	5.8
4.0929 – 6.4638%	361	19.9	7.5
6.4639 – 9.5325%	367	20.2	8.2
9.5326 – 13.8132%	363	20.0	7.7
13.8133% +	363	20.0	12.1
** Cases after in-hospital complications exclusions; comparative reference = Statewide database*			

LOS	***Compl***	***Significant Risk Factors Used for Length of Stay and In-Hospital Complications***
		• Age
		• Age-Squared
		• Alcohol and Drug Abuse (no, yes: 291.x, x=0-9; 292.0; 292.82; 303.x, x=0-9; 304.x, x=0-9; 305x, x=0-9 except 305.1; 357.5; 425.5; 535.3x, x=0,1; 571.0-571.3; 980.0; 980.9; V11.3)
✔	✔	• *Atlas Outcomes*™ Predicted Length of Stay (MQPredLOS)
		• Diabetes (no, yes: 250.0x-250.9x, x=0-3)
		• Family History of Prostate Cancer (no, yes: V16.42)
		• Heart Failure (no, yes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20-428.23, 428.30-428.33, 428.40-428.43, 428.9)
		• History of Prostate Cancer (no, yes: V10.46)
✔		• Hypertensive Disease (no, yes: 401.x, x=0-9; 402.x0, x=0-9; 403.x0, x=0-9; 404.x0, x=0-9; 405.x, x=0-9)
✔		• Median Household Income (based on zip code)
		• Obesity (no, yes: 278.00, 278.01)
		• Other Cancer—Not Prostate (metastatic: 196.0-198.81, 198.89-199.1; primary: 140.0-184.9, 186.0-195.8, 200.0-208.9, 230.0-233.3, 233.5-236.4, 236.6-239.4, 239.6-239.9)
	✔	• Poverty Rate (based on zip code)
		• Predicted Death (logit of *Atlas Outcomes*™ Predicted Probability of Death [MQPredDeath])
		• Psychological Disorder (no, yes: 295.00-301.9, 309.0-312.9)
		• Race (Black, Other, White)
		• Renal Failure (no, yes: 403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 584.5-584.9, 585, 586)